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TM 11-5821-212-10

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

RADIO TRANSMITTING SET AN/FRT-51

OPERATOR'S MANUAL

HEADQUARTERS, DEPARTMENT OF THE ARMY
FEBRUARY 1959

AGO 4407A—Feb

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT

Be careful when working on the 5,000-volt
dc high-voltage circuits, or on the
220-volt ac line connections.

DON'T TAKE CHANCES!

DANGEROUS RF VOLTAGES ARE EXPOSED AT THE
RF OUTPUT METERS AND AT THE TRANSMISSION
LINE ANTENNA COUPLER TERMINALS.

5,000 VOLTS DC EXIST IN THE FOLLOWING
UNITS OF THE TRANSMITTING SET:

Radio Frequency Amplifier AM–1154A/G
Power Supply PP–1234/G.

TECHNICAL MANUAL
No. 11–5821–212–10

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *26 February 1959*

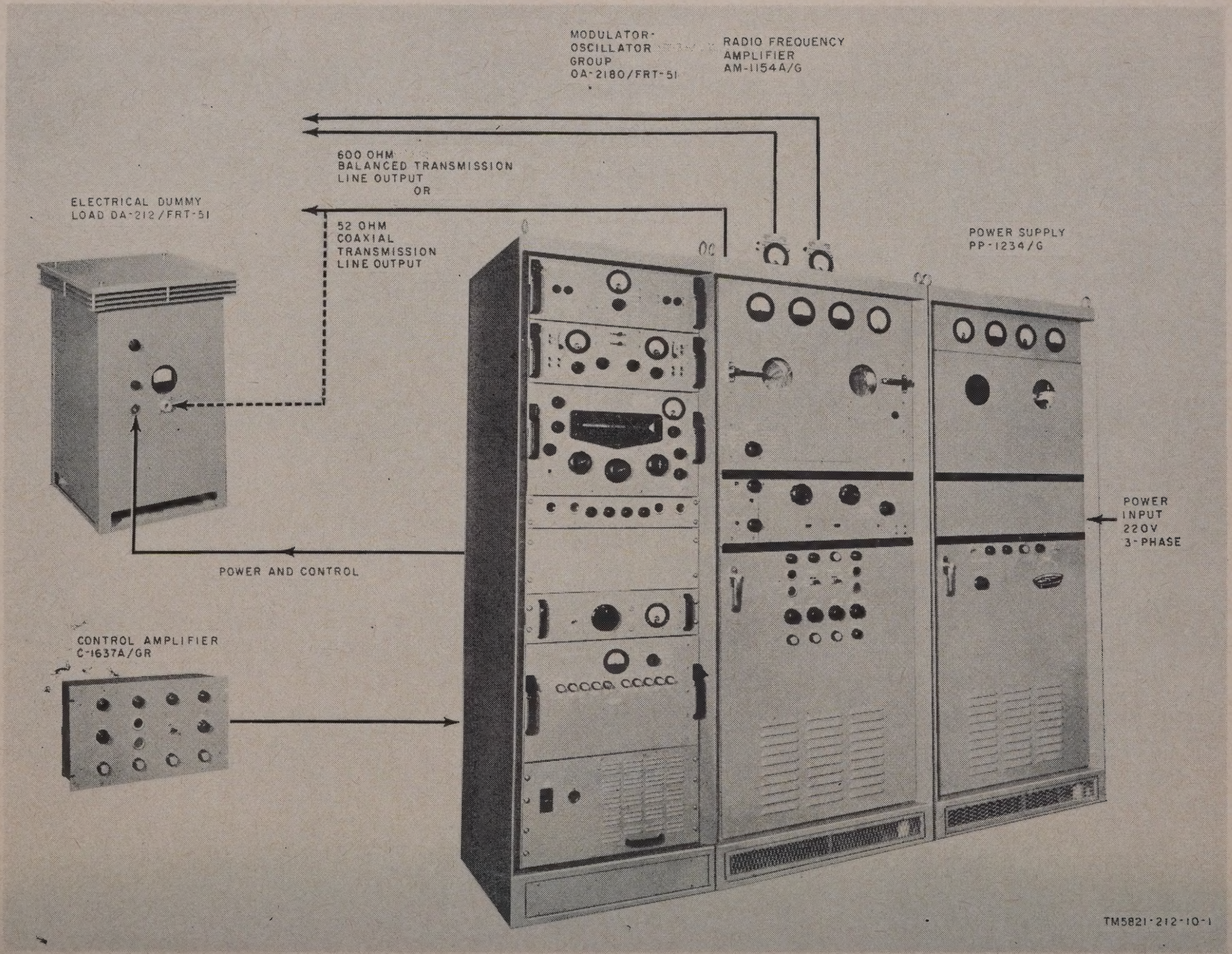

Figure 1. Radio Transmitting Set AN/FRT–51, major components.

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1. Scope

This manual covers operation and operator's maintenance of Radio Transmitting Set AN/FRT–51 (fig. 1) which, throughout this manual, is called the transmitting set.

2. Forms and Records

a. Unsatisfactory Equipment Reports. Fill out and forward DA Form 468 (Unsatisfactory Equipment Report) to Commanding Officer, United States Army Signal Equipment Support Agency, Fort Monmouth, N. J., as prescribed in AR 700–38.

b. Damaged or Improper Shipment. Fill out and forward DD Form 6, Report of Damaged or Improper Shipment, as prescribed in AR 700–58 (Army).

c. Preventive Maintenance Form. Prepare DA Form 11–238, Maintenance Check List for Signal Equipment (Sound Equipment, Radio, Direction Finding, Radar, Carrier, Radiosonde and Television) (figs. 18 and 19) in accordance with instructions on the form.

d. Comments on Manual. Forward all other comments on this publication directly to the Commanding Officer, U. S. Army Signal Publications Agency, Fort Monmouth, N. J.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

a. Transmitting set (fig. 1) consists of three major components: Power Supply PP–1234/G, Radio Frequency Amplifier AM–1154A/G, and Modulator-Oscillator Group OA–2180/FRT–51. The transmitting set may be used to develop the following types of emission:

(1) Twin or single sideband.

(2) Low-level amplitude modulation.

b. The transmitting set operates on any frequency between 1.7 megacycles (mc) to 30 mc and furnishes an output of approximately 4 kilowatts (kw) peak envelope power. It is designed to accept one or two 6-kc audio channels and to deliver power into either an unbalanced 52-ohm load or a balanced 600-ohm load. Figure 2 shows the signal, power, and control voltage paths between the major units.

c. All radio-frequency (RF) stages in Radio Frequency Amplifier AM–1154A/G are automatically servo tuned and the loading of the final amplifier stage is also servo controlled so that no manual operations are required when tuning the rf amplifier. The frequency of operation is selected by tuning the exciter equipment (Modulator-Oscillator Group OA–2180/FRT–51) to the desired frequency, whereupon the servo system resonates all of the variable tuning elements within the RF amplifier to that frequency. The servo system may be disabled, however, to permit manual tuning operations.

d. Modulator-Oscillator Group OA–2180/FRT–51 is an extremely stable RF exciter and modulator with a continuously variable output frequency within the range of 1.7 to 32.3 mc. The modulator-oscillator with the twin-sideband (TSB) modulator drawer installed has input circuits for two lines carrying voice or audio frequency telegraph signals (or multiple channels of either or both with suitable multiplexing equipment) and will drive a linear RF amplifier for highly stable twin-sideband transmission.

e. Power Supply PP–1234/G accepts 220-volt, 3-phase, 60-cycle input voltage and supplies the operating potentials to the remainder of the

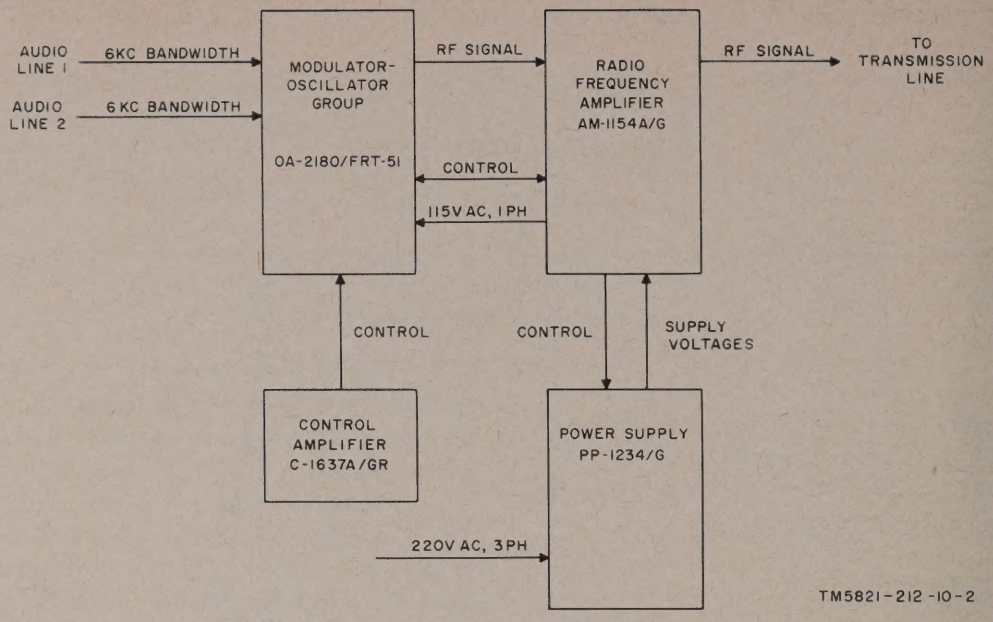

Figure 2. Transmitting set, block diagram.

transmitting set. Electrical Dummy Load DA–212/FRT–51 is provided for testing and adjustment purposes and Control Amplifier C–1637A/GR provides the necessary controls for remote operation (distance of approximately 290 feet) of the transmitting set. A set of assembled cables (fig. 3) are provided for all interunit connections.

4. Technical Characteristics

a. Radio Frequency Amplifier AM–1154A/G.

Frequency range	1.5 mc to 30 mc with an overlap of 1% at each end of the range with 52-ohm output impedance.
	2.0 mc to 30 mc with an overlap of 1% at each end of the range with 600-ohm output impedance.
Tuning method	Manual or automatic servo controlled.
Number of bands	5.
Frequency range of bands	BAND 1 ——— 1.5 to 2.3 mc (only 1.7 to 2.3 mc when used with Modulator-Oscillator Group OA–2180/FRT–51).
	2 ——— 2.3 to 4.3 mc.
	3 ——— 4.3 to 8.3.
	4 ——— 8.3 to 16.3 mc.
	5 ——— 16.3 to 30.0 mc.
RF amplifier type	Linear class B with negative RF feedback.
Types of emission	Twin-sideband or low-level amplitude modulation.
Power output	Not less than 4-kw RF peak envelope power at any frequency within the tuning range.
RF input power (from exciter)	Not more than .1 watt required to produce rated output at any frequency within the tuning range.
Input impedance	52 ohms unbalanced.
Spurious output	At least 50 db below rated output.
Output impedance	Either 52 ohms unbalanced or 600 ohms balanced.
Power supply	Power Supply PP–1234/G.
Weight	Approximately 1,075 lb.

b. Power Supply PP–1234/G.

High voltage supply output	5,000 volts.
Buffer plate supply output	1,200 volts.

screen supply output	600 volts.
Low voltage supply output	300 volts.
Power input requirements:	
Voltage	220 v ac (±15%).
Frequency	50/60 cps.
Number of phases	3.
Power	20 kva with minimum power factor of .95.
Weight	Approximately 1,970 lb.

c. Modulator-Oscillator Group OA–2180/FRT–51.

Type of emission:	
With TSB modulator drawer	Twin sideband or singlesideband suppressed carrier with carrier level adjustable 0 to 40 db below peak envelope power. Low-level amplitude modulation.
Frequency range	1.7 to 32.3 mc continuous, in .5-kc steps for maximum stability.
Power output with TSB modulator drawer	Automatically adjustable up to .1 watt maximum peak envelope power.
Frequency presentation	Direct reading on counter type dial.
Tuning method	Automatic or manual; remote or local selection of 10 preset channels.
Frequency change time	20 seconds maximum.
Frequency stability	1 part in 10^8 per day with 0.5-kc spectrum detent; ±100 cycles for continuous tuning following 24-hour warmup.
Output impedance	52 ohms unbalanced.
Input with TSB modulator drawer	Two 600-ohm unbalanced inputs.
Frequency response with TSB modulator drawer.	±1 db from 100 cps to 6,000 cps for each sideband.
Intermodulation distortion with TSB modulator drawer.	40 db below 1 tone of a standard two-tone test signal.
Spurious output	All mixer spurious outputs 60 db below peak envelope power; all harmonics of output frequency 50 db below peak envelope power.
Automatic load control with TSB modulator drawer.	Allows one sideband channel to utilize full peak envelope power in the absence of input to the other channel; overloading is prevented when both channels are active. Automatic load control compression may be metered on the front panel.
Monitoring	Built-in aural monitor of audio output is provided. Panel meters and selectors switches allow fault location and performance check of subassemblies during operation.
Cooling	Filtered forced air, positive pressure.
Input power	115 volts (115/230 volts ±15% when line voltage control is used), 50–60-cycles, 1Ø, 1,000 watts, power factor higher than 0.9.
Equipment compatibility	The modulator-oscillator contains internal circuits and connectors that are completely compatible for operation with Radio Frequency Amplifier AM–1154A/G and Power Supply PP–1234/G. This grouping provides 4 kilowatts peak envelope power output.
Remote control	Provides plate voltage switching, visual indicators, preset channel selection, and power amplifier servo tuning control.

5. Components of Transmitting Set (figs. 4, 5, and 7)

The components of the transmitting set are listed in the following table:

Quantity	Item	Height (in.)	Depth (in.)	Width (in.)	Unit weight (lb)
1	Radio Frequency Amplifier AM–1154A/G	72	30	30	1,075
1	Power Supply PP–1234/G	72	30	30	1,970
1	Modulator-Oscillator Group OA–2180/FRT–51 consisting of:				
	Electrical cabinet	72	24	22	313
	Frequency standard	8	22¼	19	37
	TSB modulator	7	22½	19	42
	Exciter-monitor	12¼	22¼	19	102
	Power supply control	3½	4½	19	4.5

Quantity	Item	Height (in.)	Depth (in.)	Width (in.)	Unit weight (ql)
	Power supply	12¼	22¼	19	129
	Blower filter assembly	10½	21½	11	24
	Main junction box	9	20½	6¼	10.5
	Automatic line voltage control panel	5¼	23½	19	73
	Blank panel	7		19	2.5
	Tool kit (Collins)	7½	8	17	20.5
1	Control Amplifier C–1637A/GR	10½	4¼	19	12
1	Electrical Dummy Load DA–212/FRT–51	30¼	20¼	20½	65
1 set	Cable assemblies (fig. 3) consisting of:				
	Electrical Power Cable Assembly CX–3678/U (50 ft)				
	Radio Frequency Cable Assembly CG–718/U (75 ft)				
	Special Purpose Electrical Cable Assembly CX–4637/U (294 ft).				
	Special Purpose Electrical Cable Assembly CX–4638/U (75 ft).				
	Special Purpose Electrical Cable Assembly CX–4639/U (25 ft).				
	RF Cable Assembly CG–497A/U (25 ft)				
	Dummy antenna ac power and interlock cable (30 ft)				
2	TM 11–5821–212–10				
1 set	Running spares (par. 6).				

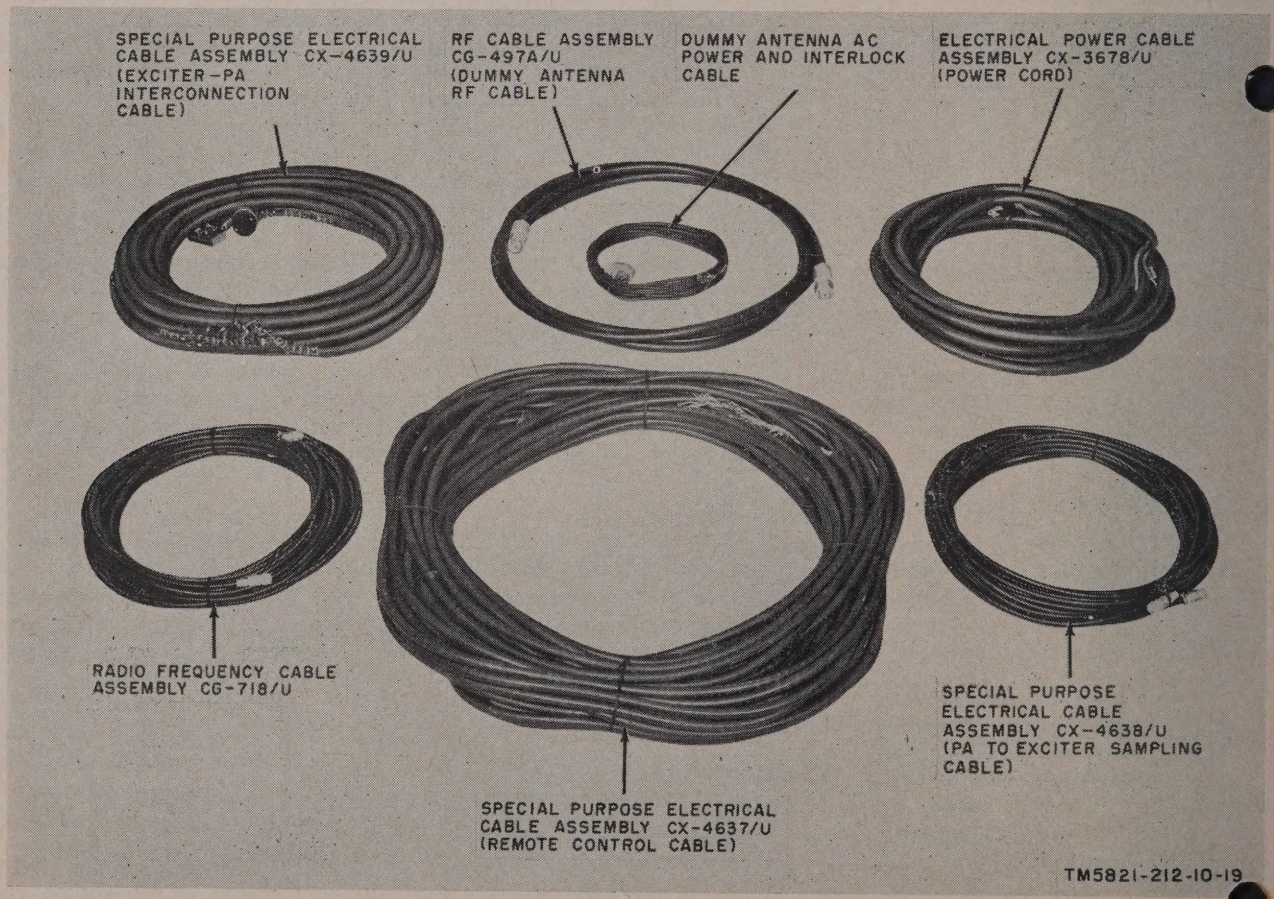

Figure 3. Cable assemblies.

6. Running Spares

a. Radio Frequency Amplifier AM–1154A/G.

Qty	Item
1	Air filter
1	Electron tube OA3
1	Electron tube 6AS7G
1	Electron tube 5R4WGY
1	Electron tube 4CX250B
2	Electron tubes 5751
1	Electron tube 5726/6AL5W
1	Electron tube 12AT7WA
2	Electron tubes 4–1000A
1	Electron tube 6AH6WA
2	Electron tubes 5814A
1	Electron tube 6AV6
2	Electron tubes 6012
3	Incandescent lamps, 6 watts, 120 volts, bayonet
6	Cartridge fuses, 1.5 amp, 125 volts MIL type F02D1R50B
6	Cartridge fuses, 3 amp, 125 volts, MIL type F02D3R00B
6	Cartridge fuses, 1.5 amp, 250 volts, MIL type F02G1R50A
24	Cartridge fuses, 3 amp, 250 volts, MIL type F02G3R00A
6	Cartridge fuses, 6 amp, 250 volts, MIL type F02G6R00A
12	Cartridge fuses, .5 amp, 250 volts MIL type F02GR500B

b. Power Supply PP–1234/G.

Qty	Item
1	Air filter
2	Electron tubes 3B28
3	Electron tubes 4B32
1	Electron tube, 5R4WGY
2	Incandescent lamps, 6 watts, 120 volts, bayonet

c. Control Amplifier C–1637A/GR.

Qty	Item
3	Incandescent lamps, 6 watts, 120 volts, bayonet

d. Dummy Antenna.

Qty	Item
6	Cartridge fuses, 3 amp, 250 volts, MIL type F02G3R00A

e. Modulator-Oscillator Group OA–2180/FRT–51.

Qty	Item
1	Electron tube 6012
1	Electron tube 5879
6	Cartridge fuses, 1.5 amp, 125 volts, MIL type F02D1R50B
6	Cartridge fuses, 2 amp, 125 volts, MIL type F02D2R00B
6	Cartridge fuses, 3 amp, 125 volts, MIL type F02D3R00B
6	Cartridge fuses, 0.062 amp, 250 volts, MIL type F02GR062B
6	Cartridge fuses, 0.125 amp, 250 volts, MIL type F02GR125B
6	Cartridge fuses, 0.5 amp, 250 volts, MIL type F02GR500B
6	Cartridge fuses, 0.75 amp, 250 volts, MIL type F02GR750B
6	Cartridge fuses, 1 amp, 250 volts MIL type F02G1R00B

7. Common Names

Nomenclature	Common name
Radio Frequency Amplifier AM–1154A/G.	RF amplifier
Power Supply PP–1234/G	Hv power supply
Control Amplifier C–1637A/GR.	Remote control unit
Modulator-Oscillator Group OA–2180/FRT–51.	Modulator-oscillator
Electrical Dummy Load DA–212/FRT–51.	Dummy antenna

8. Description

a. The transmitting set includes three major units; an RF amplifier, a high voltage (hv) power supply, and a modulator-oscillator unit (fig. 1). A dummy antenna is used to test and adjust the RF amplifier. A remote control unit turns the power on and off and tunes the RF amplifier unit The equipment of each major unit is housed in a separate steel cabinet. In a normal installation, the three major units are situated alongside one another, and connected with cables supplied with the equipment. The controls, indicator lights, and test meters that are used to operate the equipment and to monitor operating conditions are mounted on the front panel on each unit. Glass-covered ports are in-

cluded in the panels so that interior inspections may be made while the equipment is operating.

b. The RF amplifier (fig. 1) contains the controls and the meters of the equipment on its front panel. Two RF ammeters are mounted on top of the cabinet. The RF amplifier is automatically tuned by servo units. Knobs connected to servo drive shafts provide for manual control of the variable elements. The equipment of the RF amplifier unit is divided into two groups. One group, mounted on a roll-out drawer type chassis in the upper half of the cabinet, consists of the power amplifier, driver chassis, servo preamplifier chassis, and a junction box. The second group, mounted in the lower half of the cabinet, consists of a control chassis, bias supply, terminal board chassis, and a blower assembly.

c. The hv power supply (fig. 1) furnishes alternating current (ac) and direct current (dc) potentials required by the RF amplifier. It also provides 115 volts ac to the modulator-oscillator unit. It operates on 220-volt 50/60-cycle, 3-phase power. Access to the equipment is provided by the cabinet door, on which are mounted the control switches and indicator lights. Meters for monitoring the supply voltages are mounted on a front panel above the door. Included in the cabinet are circuit breakers (fig. 6) that control the application of input power to the circuits of the power supply, the RF amplifier, and modulator-oscillator chassis. Input power is applied through a permanently connected cable. Signal and servo control voltage connections to the equipment are made to a terminal board chassis in the RF amplifier cabinet.

d. The modulator-oscillator consists of the panel-chassis assemblies ilustrated in figure 7. Each unit may be pulled out of the cabinet for servicing. Screw fasteners on the front panel of each unit secure the units to the cabinet. The LINE SWITCH on the blower filter assembly panel controls application of power to the modulator-oscillator power supply and the frequency standard chassis. The power supply control panel switches filament and plate power to the remaining units. The automatic line voltage control panel provides continuous adjustment of the line voltage to 115 volts under normal operating conditions. All power and control circuit interconections between units of this group and between the hv power supply and RF amplifier are made through the main junction box in the lower left corner of the modulator-oscillator cabinet.

(1) *Frequency standard.* The frequency standard consists of six removable subassemblies that are secured to the frequency standard chassis by captive screws. The front panel contains a centrally located test meter, meter switch, and four openings for access to screwdriver adjustable potentiometers and a trimmer capacitor.

(2) *TSB modulator.* The TSB modulator contains six removable subassemblies that are secured to the TSB modulator chassis by captive screws. The front panel of the TSB modulator contains the required operating controls and a sideband interchange relay. Two volume unit (vu) meters are provided to measure the level of the audio signal on both input lines.

(3) *Exciter-monitor.* The exciter-monitor contains 16 removable subassemblies. The front panel assembly contains a test meter and the required operating controls for the exciter-monitor. The signal paths between the subassemblies and other units are completed by miniature coaxial cables. Power and control circuit connections are completed to the main junction box by an external cable. The interpolation oscillator and master oscillator are housed in tank type oven assemblies.

(4) *Power supply control panel.* The power supply control panel contains momentary pushbutton type switches that control the application of filament and plate power to all units except the modulator-oscillator power supply and frequency standard chassis. Three indicator lamps glow when the line, filament, and plate voltage is applied; a fourth lamp indicates when the stabilized master oscillator (SMO) is phased locked.

(5) *Automatic line voltage control.* The automatic line voltage control panel provides for manual or automatic line

voltage control. The front panel contains the necessary controls and adjustments and a meter to indicate the adjusted line voltage.

(6) *Modulator-oscillator power supply.* The modulator-oscillator power supply furnishes power to all the units in the modulator-oscillator unit. Interconnections between the modulator-oscillator power supply and the other assemblies of the unit are made through the main junction box ((7) below) and interconnecting cabling. The front panel contains 10 fuse holders with blown-fuse indications. A METER switch, together with a test meter, indicates the voltages at the various units in the modulator-oscillator.

(7) *Blower filter assembly.* The blower filter assembly contains the main junction box and a LINE SWITCH which controls the application of power to the modulator-oscillator power supply and the frequency standard chassis. A 115-volt ac utility outlet is also located on the front panel.

e. The remote control unit (fig. 1) contains controls which are paralleled with similar controls on the rf amplifier and the modulator-oscillator to enable a remote operator to select operating functions. Indicator lights on the remote control unit reveal operating conditions.

f. The dummy antenna (fig. 1) is used as a load impedance for the RF amplifier during operational tests and adjustments. The dummy antenna must be connected manually to the RF amplifier output. A blower provides forced-air cooling of the dummy antenna. An air switch actuated by the air stream from the blower is connected in the RF amplifier interlock circuit when the dummy antenna is being used.

9. Additional Equipment Required

The additional equipment required for the operation of the transmitting set depends on the type of service to be performed. In all types of installations, it is necessary to have a power source of 220 volts ac, 3-phase, 20,000 watts minimum, and an antenna system. The following additional equipment is required for the types of operation listed below:

a. High-Level Amplitude Modulator (HLAM).

(1) Radio Modulator MD–248A/G.

(2) A 600-ohm input and a suitable antenna system.

b. CW/FSK Operation.

(1) On-off or frequency-shift keyer.

(2) Suitable antenna system.

c. Single Sideband or Twin Sideband. A line equalizing amplifier is required when the audio input is applied from a balanced line or for amplification purposes if the incoming audio signal is below 0 VU.

CHAPTER 2

OPERATING INSTRUCTIONS

Section I. CONTROLS AND INDICATORS

10. Faulty Operation Resulting from Improper Settings

Take the following precautions when setting the controls:

a. When Modulator-Oscillator Group OA–2180/FRT–51 is used as the exciter source, the BAND SWITCH on the RF amplifier (fig. 4) must be set to OFF for either manual or automatic tuning.

b. To prevent loss of channel settings on the exciter-monitor (fig. 10), make sure that the locking wing nuts for the FREQ–KC, FREQ–MC, and BAND controls are tightened clockwise before pressing the FILAMENT ON button on the power control panel, switching the REMOTE-LOCAL control, or switching the CHANNEL selector.

c. The correct operation of the equipment is covered in paragraphs 21 through 35.

11. RF Amplifier
(fig. 4)

Control or indicator	Function
STANDBY ON and OFF locking pushbutton switches.	Applies power to the filament circuits, the pa bias supply, and blowers in the RF amplifier and hv power supply, placing the hv power supply and RF amplifier in the standby operating condition. The FILAMENT and BIAS lamps light, indicating these conditions.
PLATE ON momentary pushbutton switch.	Applies high voltage to the equipment. The PLATE lamp indicates this condition.
PLATE OFF/RESET momentary pushbutton switch.	Removes high voltage from the equipment. If the alarm energizes because of some bias supply circuit failure, this switch must be pressed before power can be reapplied by the PLATE ON switch.
POWER switch	Selects power condition of rf amplifier. During manual tuning operations, this switch is set at the TUNE position. For full power operation, this switch is set at the NORMAL position. For reduced power operation, this switch is set at the LOW position. During SSB service, this switch must be set at the NORMAL position.
CONTROL switch	Selects either remote or local control of the RF amplifier. If the remote control is to be used, this switch is set at the REMOTE position.
SERVICE switch	Selects the type of service for the RF amplifier. Switch positions and the corresponding types of operation are as follows: *Position* — *Service* SSB — Reduced carrier, single-sideband operation. Twin-sideband operation. Low-level amplitude-modulated operation. CW/FSK — Either continuous-wave or frequency-shift keyed operation, depending upon excitation. HLAM — High-level amplitude-modulated operation. *Notes.* 1. CW/FSK and HLAM operations are not possible without the use of additional equipment (par. 9). 2. The SERVICE switch is inoperative when the plate voltage is turned on. Corresponding lamps on the control panel light to indicate the selected type of service.
TUNING switch	Selects either MANUAL or AUTOMATIC servo control of the tuning elements in the rf amplifier.

Control or indicator	Function
AUTOMATIC TUNING switch	Controls application of servo power. With the TUNING switch set to AUTOMATIC, switch positions and corresponding types of servo operation are as follows: *Position* — *Operation* OPERATE — Servo power is applied continuously for constant surveillance. In this position, the servos will compensate for any drifting of tuned circuits and changes in antenna impedance when on the air for extensive periods. CYCLE OFF — Servo power is applied only during the tuneup cycle. After the tuneup cycle is complete, servo power is removed. In this position, servos will not compensate for any circuit or antenna impedance changes. RESET — Servo power is applied as long as switch is held at RESET to allow for minor touchup in tuning for small frequency changes.
TRANSMITTER TEST switch	Grounds the carrier reinsert bus to the modulator-oscillator continuously in the HOLD position, momentarily in the MOMENTARY position. In the OPERATE position, the switch is open. *Note.* This switch can be used with other exciters where the keying switch is in the ground return of the keying relay or circuit.
FILAMENT green lamp	Indicates presence of ac power in filament circuits.
BIAS amber lamp	Indicates presence of bias voltage in RF amplifier.
ALARM white lamp	Provides visual warning of failure of any one of the dc supply circuits in the hv power supply assembly.
PLATE red lamp	Indicates high voltage supply is on.
AUTO-TUNED blue lamp	Indicates that the RF amplifier tuning cycle is completed.
SSB, CW/FSK, and HLAM white lamps.	Indicate the type of service being used.
BAND SWITCH	Provides local control of the band of operation (1–5) in which the RF amplifier is being operated. ***Caution:* This switch must be in the OFF position whenever Modulator-Oscillator Group OA–2180/FRT–51 is used as the exciter for this equipment.**
BUFFER TUNING KNOB	Provides manual control of the variable tuning elements in the input amplifier and buffer plate tank circuits. The dial at the left of the control is referred to and compared with the tuning chart (fig. 16) during manual tuning operation.
DRIVER PLATE TUNING KNOB	Provides manual control of the variable tuning elements in the driver plate tank circuit. The dial at the left of the control is referred to and compared with the tuning chart (fig. 17) during manual tuning operation.
PA PLATE TUNING KNOB	Provides manual control of the variable tuning elements in the power amplifier output network. The dial below the control is referred to during manual tuning operation. The number on the dial should indicate (in mc) the approximate input frequency.
PA LOADING KNOB	Provides manual control of the variable loading elements in the power amplifier output network. The dial reading below the control is referred to during manual tuning operations. The number on the dial should indicate (in mc) the approximate input frequency.
MULTIMETER switch and MULTIMETER.	Meter monitors any one of eight circuits in the RF amplifier. Switch positions and monitoring functions are as follows: *Position* — *Function* OFF — Meter disconnected. INPUT AMPLR CATHODE 0–100MA — Measures the cathode current in this stage. BUFFER AMPLR CATHODE 0–500MA — Measures the cathode current in this stage.

Control or indicator	Function
	Position — *Function* LEFT 4–1000A CATHODE 0–1000MA — Measures the cathode current in this tube of the power amplifier. CENTER 4–1000A CATHODE 0–1000MA — Measures the cathode current in this tube of the power amplifier. RIGHT 4–1000A CATHODE 0–1000MA — Measures the cathode current in this tube of the power amplifier. POWER AMPLR SCREEN 0–1000MA — Measures the current being drawn by the power amplifier screen grids. POWER AMPLR BIAS 0–500V — Indicates the level of the bias voltage being applied to the power amplifier control grids. BUFFER-DRIVER BIAS 0–100V — Indicates the level of the bias voltage being applied to the control grids of the buffer and driver stages.
600-ohm output meters (located on top of rf amplifier chassis).	Measure 600-ohm transmission line current.
DRIVER CATHODE milliammeter	Measures cathode current in the driver stage.
PA GRID milliammeter	Measures grid current in the power amplifier.
PA PLATE ammeter	Measures the power amplifier plate current.
Rf ammeter	Measures rf output current into 52-ohm output cable (meter observed through right-hand circular window on pa panel).
Test button for RF ammeter (located below and to the right of the right viewing port).	Removes short from RF ammeter. Button must be pressed in to read RF output current.

12. Hv Power Supply

a. Front Panel Controls (fig. 5).

Control or indicator	Function
LINE ADJUST INCREASE switch	Provides manual adjustment of the 3-phase input autotransformer.
ADJUSTED LINE VOLTAGE switch and ADJUSTED LINE voltmeter.	Meter monitors the three ac line-to-line output voltages of the power supply.
PA SCREEN dc voltmeter	Meters the output voltage of the pa screen supply.
BUFFER PLATE dc voltmeter	Meters the output voltage of the buffer plate supply.
PA PLATE dc voltmeter	Meters the output voltage of the high voltage supply.
FILAMENT green lamp	Indicates presence of ac in the filament circuits.
BIAS amber lamp	Indicates presence of dc in the power amplifier bias supply in the RF amplifier.
ALARM white lamp	Provides visual warning of failure of any one of the dc supply circuits in the power supply.
PLATE red lamp	Indicates presence of dc in the plate circuits.
ALARM audible visual toggle switch	Provides selection of either an audible or visual alarm which is energized by the alarm circuit in the event of failure of one of the dc supply circuit.
ALARM TEST toggle switch	Enables the power supply alarm circuit to be energized for test purposes.

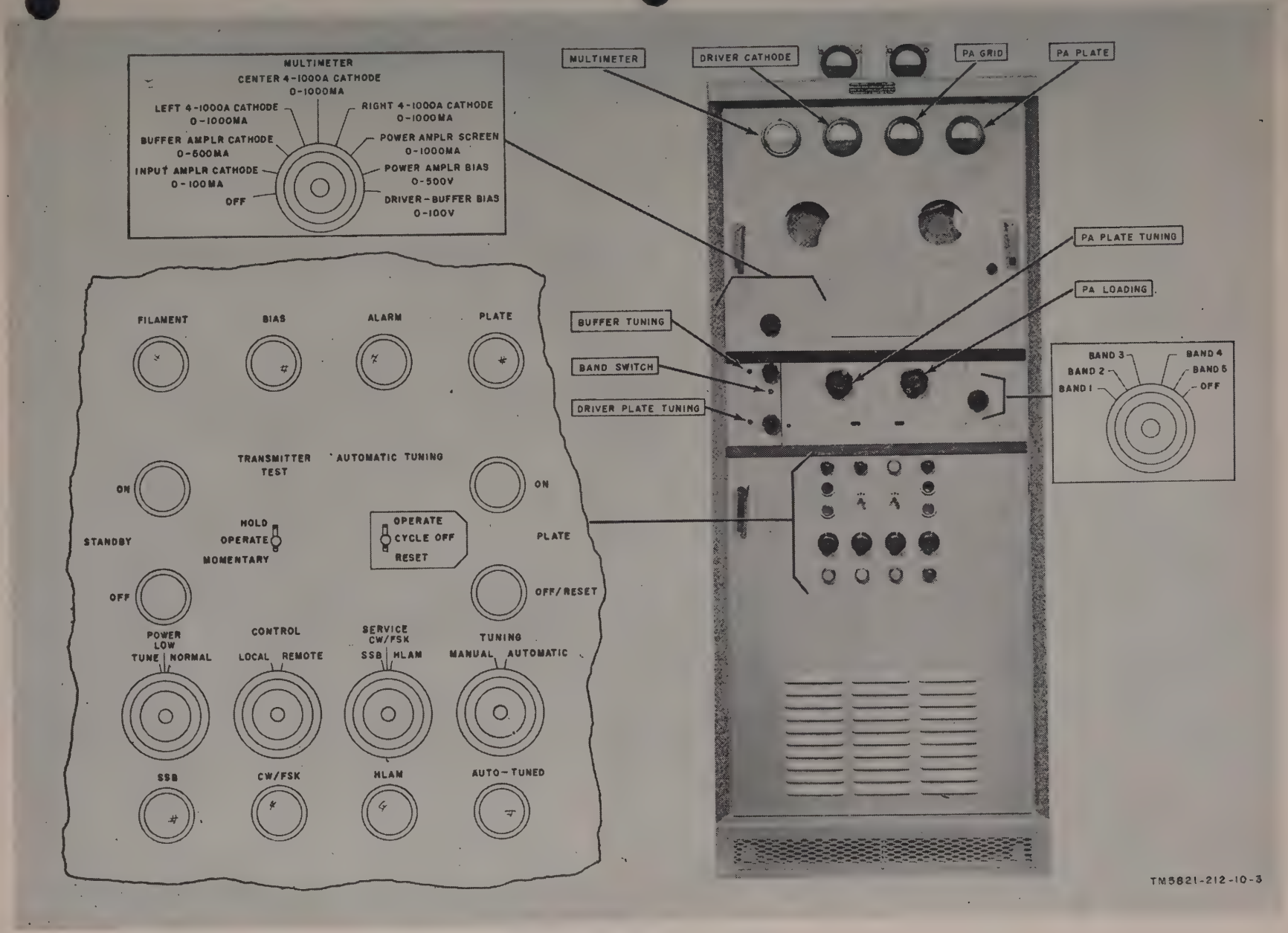

Figure 4. RF amplifier, front panel.

b. Circuit Breakers (fig. 6).

Control or indicator	Function
PWR INPUT	Controls application of 220-volt, 50/60-cycle, 3-phase input power to the power supply. Applies 115-volt single-phase ac to the modulator-oscillator.
PS BLOWER	Controls application of 220-volt, 3-phase power to the hv power supply blower.
PA BLOWER	Controls application of 220-volt, 3-phase power to the blower in the RF amplifier cabinet.
HV FIL	Controls application of 220-volt, 3-phase power to rectifier filament transformers in the high voltage supply.
HV PLATE	Controls application of 220-volt, 3-phase power to the rectifier plate transformer in the high voltage supply.
RECT FIL	Controls application of 220-volt, single-phase power to rectifier filament transformers in the buffer plate, pa screen, and low voltage supplies.
PA BIAS	Controls application of 220-volt, single-phase power to power amplifier bias supply in the RF amplifier.
BUFFER PLATE	Controls application of 220-volt, single-phase power to the rectifier plate transformer in the buffer plate supply.
PA SCREEN	Controls application of 220-volt, single-phase power to the rectifier plate transformer in the pa screen supply.
CONTROL LINE	Controls application of 127-volt, single-phase power to the control line transformer in the RF amplifier.

13. Frequency Standard (figs. 7 and 8)

Note. Paragraphs 13 through 19 describe the controls and instruments of the modulator-oscillator assembly.

Function	Control or indicator
1MC STANDARD TRIM (screwdriver adjustment)*.	Provides fine adjustment of output frequency of lmc crystal oscillator. *Note.* 1MC standard lock must be loosened before making this adjustment.
1MC STANDARD LOCK (screwdriver adjustment)*.	Mechanically locks 1MC STANDARD TRIM trimmer capacitor in position.
100 KC LEVEL (screwdriver adjustment)*.	Controls the gain of 100-kc output.
250 KC LEVEL (screwdriver adjustment)*.	Controls the gain of 250-kc output.
Test METER and METER switch	Meter monitors any one of 12 circuits which may be selected by the METER switch. Switch positions and monitoring functions are as follows:

Position	*Function*
1. OVEN–OSC	Indicates crystal oscillator oven voltage.
2. 1 MC OSC	Indicates level of agc potential supplied by final buffer stage in crystal oscillator.
3. 900 KC DIV	Indicates level of 900-kc signal developed in 1-mc to 100-kc divider.
4. 300 KC DIV	Indicates level of 300-kc output of 1-mc to 100-kc divider.
5. 100 KC DIV	Indicates level of 100-kc output of 1-mc to 100-kc divider.
6. 100 KC GEN	Indicates level of 100-kc output of 100-kc and 250-kc generator.
7. 250 KC GEN	Indicates level of 250-kc output of 100-kc and 250-kc generator.
8. 75/100 KC	Indicates combined level of 75-kc and 100-kc input signals to the mixer half of the divider in the 100-kc and 250-kc generator.

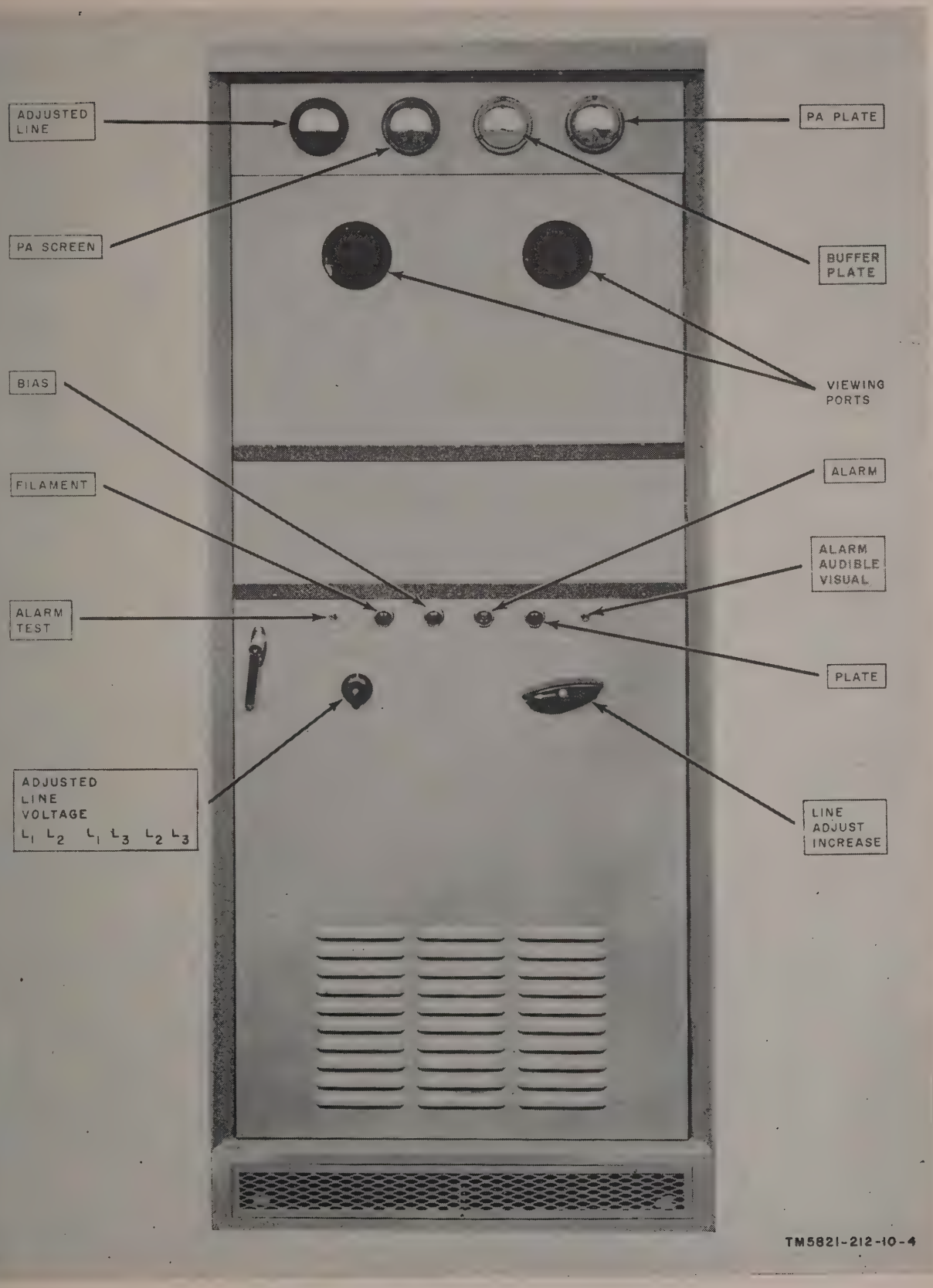

Figure 5. Hv power supply, front panel.

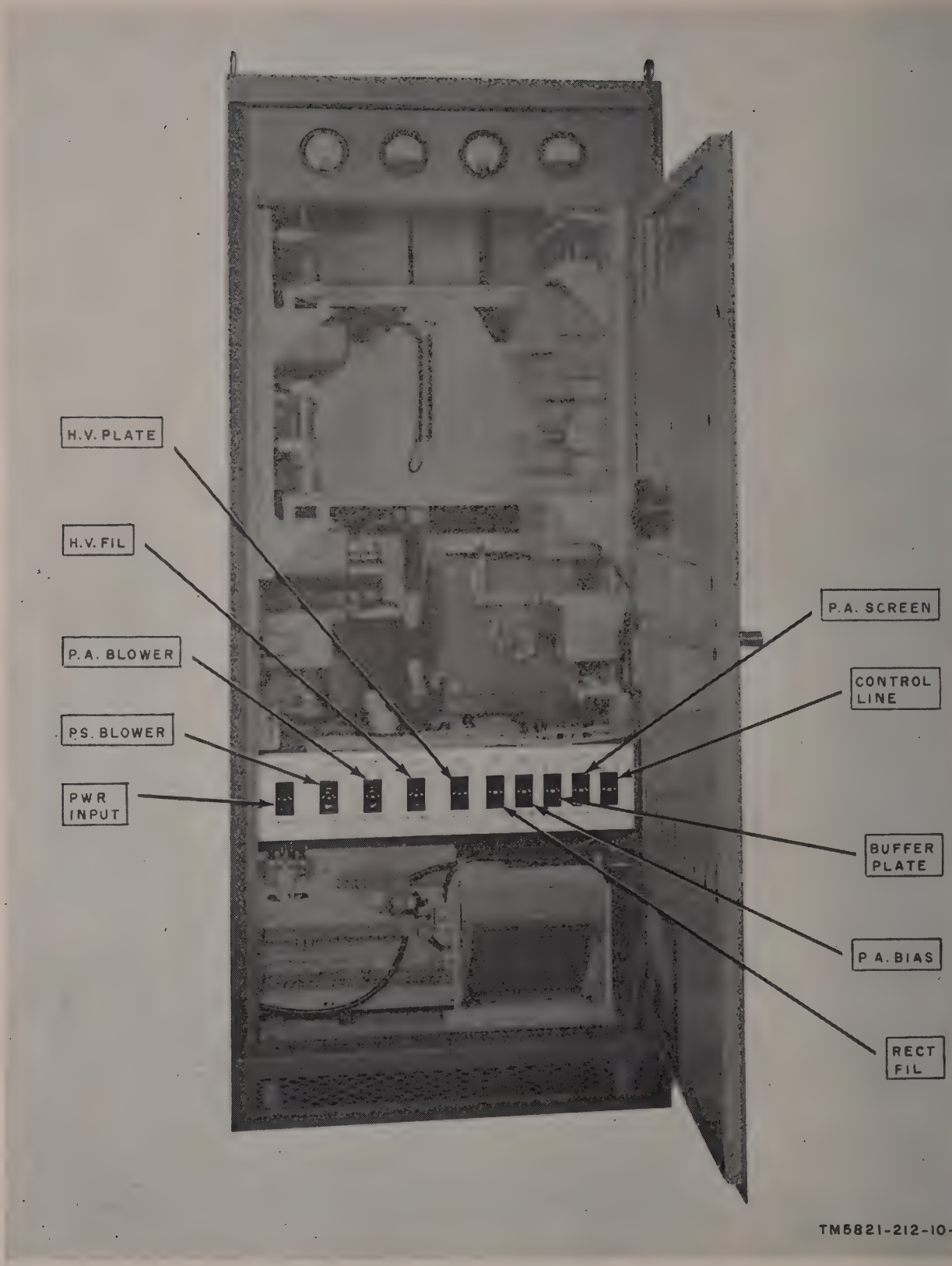

Figure 6. Hv power supply, location of circuit breakers.

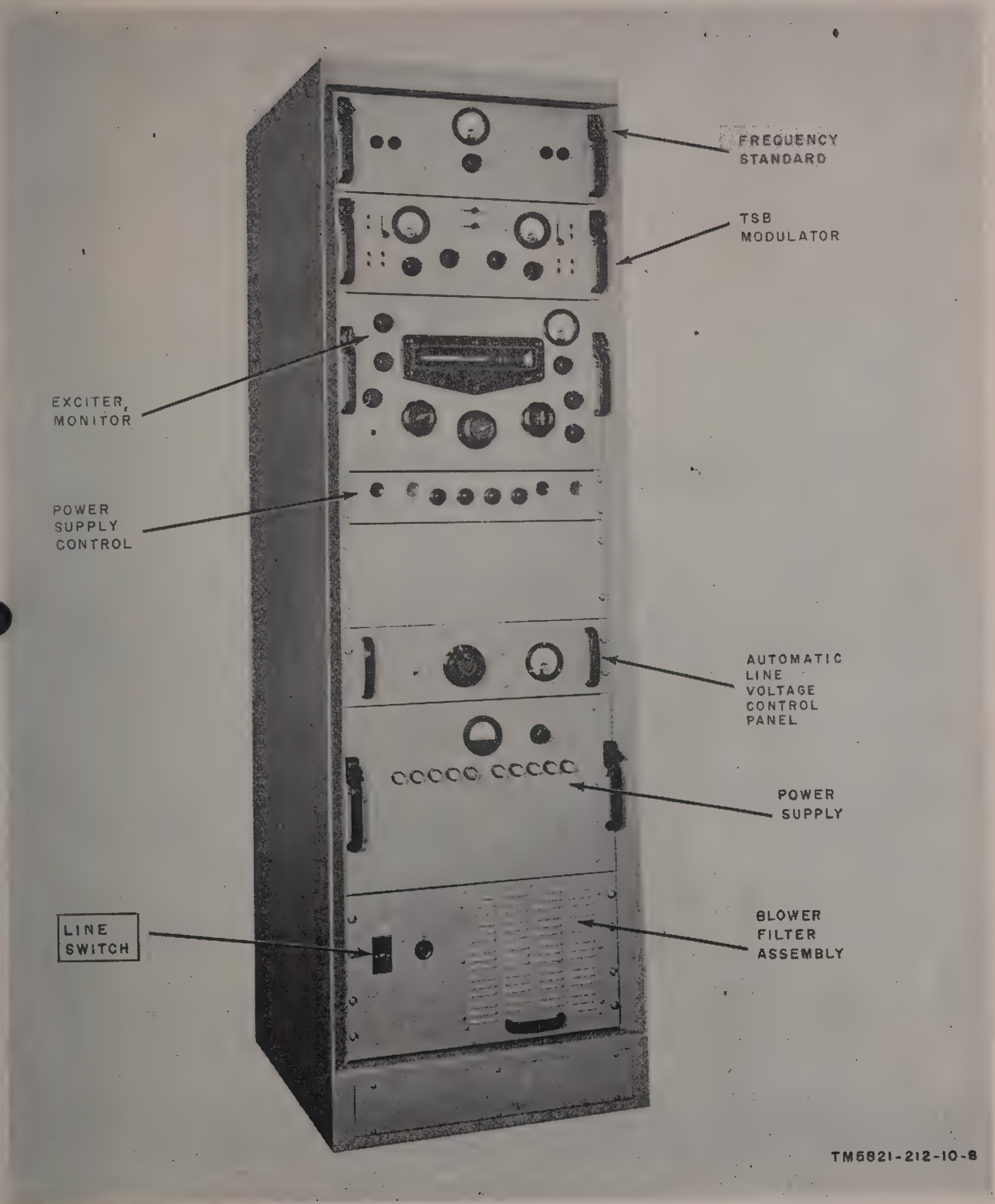

Figure 7. Modulator-oscillator, location of subchassis.

Control or indicator	Function
	Position — *Function* 9. 5 KC DIV — Indicates level of 5-kc output of 25-kc-1-kc divider. 10. 1 KC DIV — Indicates level of 1-kc output of 25-kc-1-kc divider. 11. 1.5 KC GEN — Indicates level of 1.5-kc output from 4.5-kc generator. 12. 4.5 KC GEN — Indicates level of 4-5-kc output from 4.5-kc-generator.

* Not an operator's adjustment.

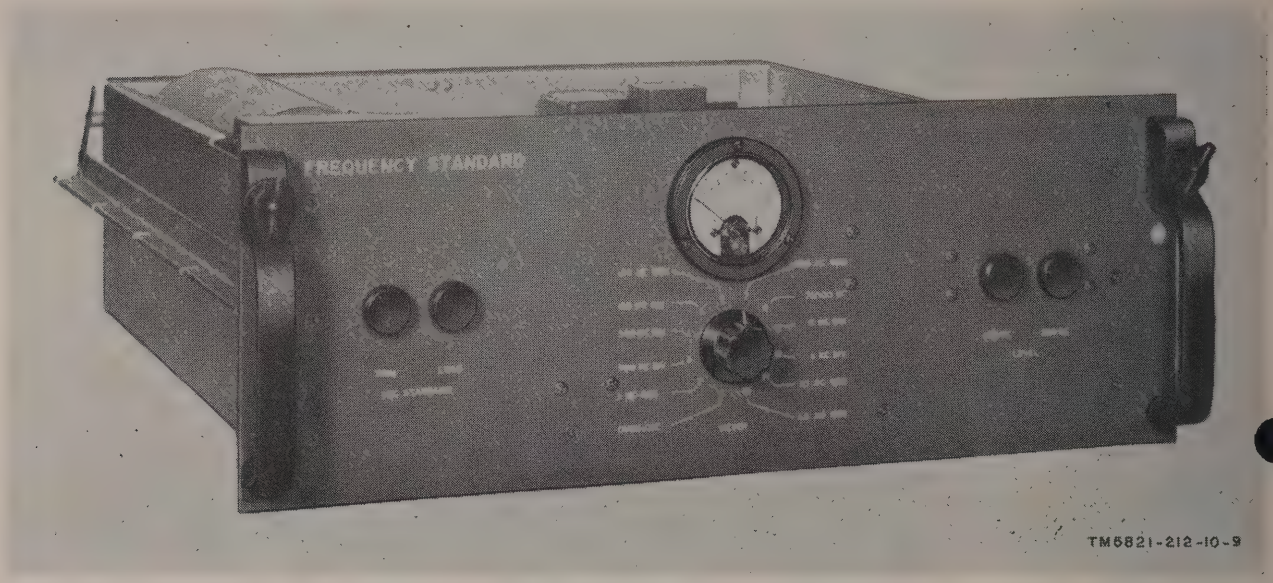

Figure 8. Frequency standard, front panel.

14. TSB Modulator
(figs. 7 and 9)

Control or indicator	Function
UPPER SIDEBAND selector switch	Controls the application of either the LINE 1 or LINE 2 audio input to the upper sideband channel of the twin sideband generator. When the switch is in the OFF position, a test signal connected to the TEST AUDIO INPUT jack is applied by the switch to the twin sideband generator.
LOWER SIDEBAND selector switch	Controls the application of either the LINE 1 or LINE 2 audio input to the lower sideband channel of the twin sideband generator. When the switch is in the OFF position, a test signal connected to the TEST AUDIO INPUT jack is applied by the switch to the twin sideband generator.
TEST AUDIO INPUT jacks	Provide connection for audio test signal to TSB modulator.
LINE 1 METER jacks	Provides connection for reading test signals directly on LINE 1 VU meter.
LINE 1 audio LEVEL control	Adjusts the level of the LINE 1 audio input. Clockwise rotation increases the level.
LINE 1 VU meter	Measures the level of LINE 1 audio input of automatic load control compression.
LINE 1 METER switch	Connects any one of three different circuits to LINE 1 METER. Switch positions are as follows: *Position* — *Function* 0 — Provides normal level indication on meter.

Control or indicator	Function
	Position / *Function* +6 — Reduces meter sensitivity so that signal level is 6 db higher than meter indication. ALC — Provides meter indication of approximate automatic load control (ALC) compression in db.
LINE 2 audio LEVEL control	Adjusts the level of the LINE 2 audio input. Clockwise rotation increases the level.
LINE 2 VU meter	Measures the level of LINE 2 audio input on ALC compression.
LINE 2 METER switch	Connects any one of three different circuits to LINE 2 METER. Switch positions are as follows: *Position* / *Function* 0 — Provides normal level indication on meter. +6 — Reduces meter sensitivity so that signal level is 6 db higher than meter indication. ALC — Provides meter indication of approximate ALC compression in db.
LINE 2 METER jacks	Provides connection for reading test signals directly on LINE 2 VU meter.
MONITOR AUDIO OUTPUT jacks	Provide connection to audio output of low-frequency monitor in exciter-monitor compartment.
DB CARRIER ATTENUATION variable attenuators.	Set the level of carrier signal that is reinserted in the output of the twin-sideband generator.

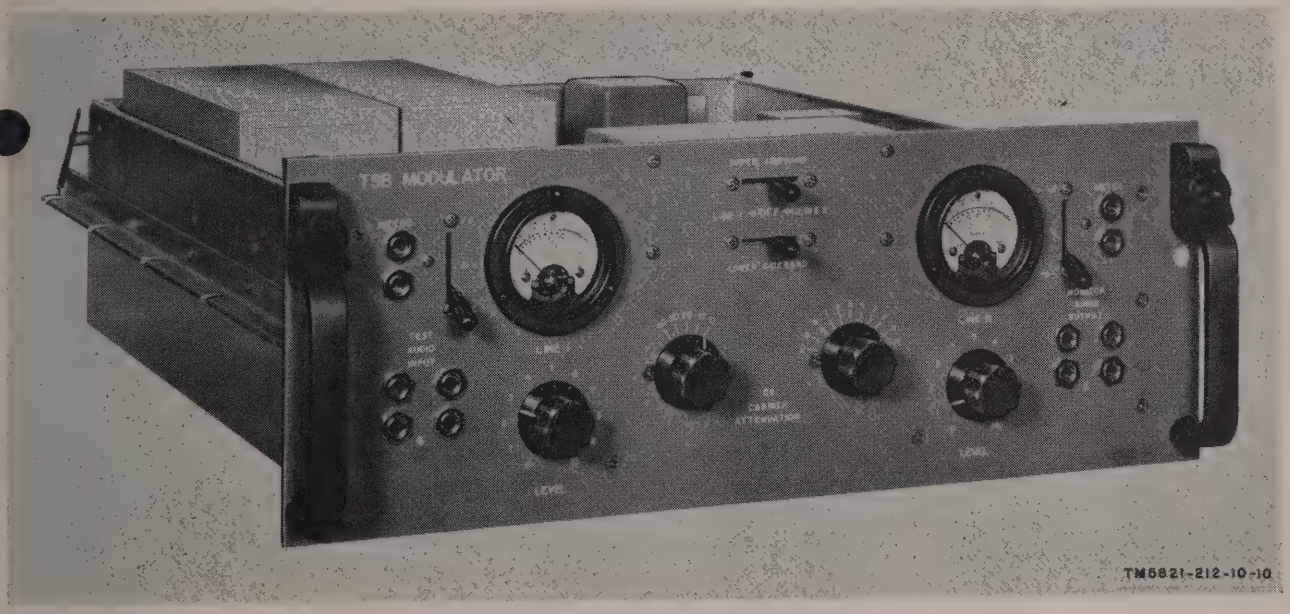

Figure 9. TSB modulator, front panel.

15. Exciter-Monitor (figs. 7 and 10)

Control or indicator	Function
REMOTE-LOCAL switch	Selects either remote or local control of channel selection.
CHANNEL selector switch	Selects the preset channel on which operation is desired. The numerals engraved around the switch designate the 10 autotune channels available. The frequency corresponding to any one of these channels may be readily changed to any frequency within the range of 1.7 to 30 mc.

Control or indicator	Function
0.5 KC LOCK switch	Locks the operating frequency at .5 kc points. If the operating frequency falls on a .5-kc point, set the 0.5 KC LOCK switch to ON. If the operating frequency falls between .5 kc, the 0.5 KC LOCK must be set to OFF.
Test meter and METER SWITCH	Meter monitors any one of six circuits which may be selected by the METER SWITCH. Switch positions and monitoring functions are as follows:

Position	*Function*
1. MONITOR SIGNAL LEVEL	Indicates the level of the signal selected by the MONITOR INPUT selector switch.
2. MO CONTROL CURRENT	Indicates cathode current in the control tube of the stabilized master oscillator (SMO) error detector.
3. ∅ DETECTOR INPUT	Indicates signal level at the phase detector input of SMO error detector.
4. ∅ DETECTOR REFERENCE	Indicates level of the phase detector reference signal in the SMO error detector.
5. LOW FRQ INJECTION	Indicates level of output of master oscillator buffer in SMO RF chassis.
6. HIGH FREQ INJECTION	Indicates level of output of multiplier V1506 in stablized master oscillator RF chassis.

MONITOR LEVEL	Controls the level of the signal applied to the monitor circuits. Clockwise rotation increases the signal level.
MONITOR INPUT selector switch	With the METER SWITCH in position 1, the MONITOR INPUT selector switch applies signals to the meter and to the MONITOR AUDIO OUTPUT jacks in the TSB modulator. Switch positions and corresponding monitor inputs are as follows:

Position	*Input*
EXCITER INPUT	300-kc signal from TSB modulator.
EXCITER OUTPUT	1.7-mc to 32.3-mc output of modulator-oscillator group.
PA SAMPLING	1.7-mc to 32.3-mc amplified signal from power amplifier in amplifier power supply group.
EXTERNAL	Signal from external source.
TEST	300-kc test signal from frequency standard.

EXTERNAL PICKUP jack	Provides connection for test signal input to monitor circuits.
FREQ-MC control	Selects any 0.1-mc tuning step and changes reading of the mc digits of frequency-indicating dial. The tuning may be done manually when the locking key in the center of the control is turned counterclockwise. When the key is turned clockwise, the control is locked and under the control of the servo mechanism. When using the FREQ-MC control to set up an operating frequency, make sure that the mechanical detent is engaged.
FREQ-KC control	Tunes the modulator-oscillator group to any frequency over the 100-kc range selected by FREQ-MC control, and changes reading of last three digits on frequency-indicating dial. The tuning may be done manually when the locking keys in the center of the FREQ-MC and FREQ-KC are turned counterclockwise. When the key is turned fully clockwise, the control is locked and is under the control of the servo mechanism.

Note. Unlock the FREQ-MC control before manually operating the FREQ-KC control. See that the FREQ-MC mechanical detent follower is seated in a detent notch before relocking the FREQ-MC control. The SMO will not stabilize if the detent is not seated.

BAND switch	Controls function of the exciter-monitor TSB modulator and power amplifier for operation of a transmitter on the five bands within the frequency range 1.7 mc and 32.3 mc. When the locking key is turned counterclockwise, the band switch may be rotated manually. When the key is turned fully clockwise, the switch is locked and is under the control of the servo mechanism. The switch positions and the corresponding frequency ranges are as follows:

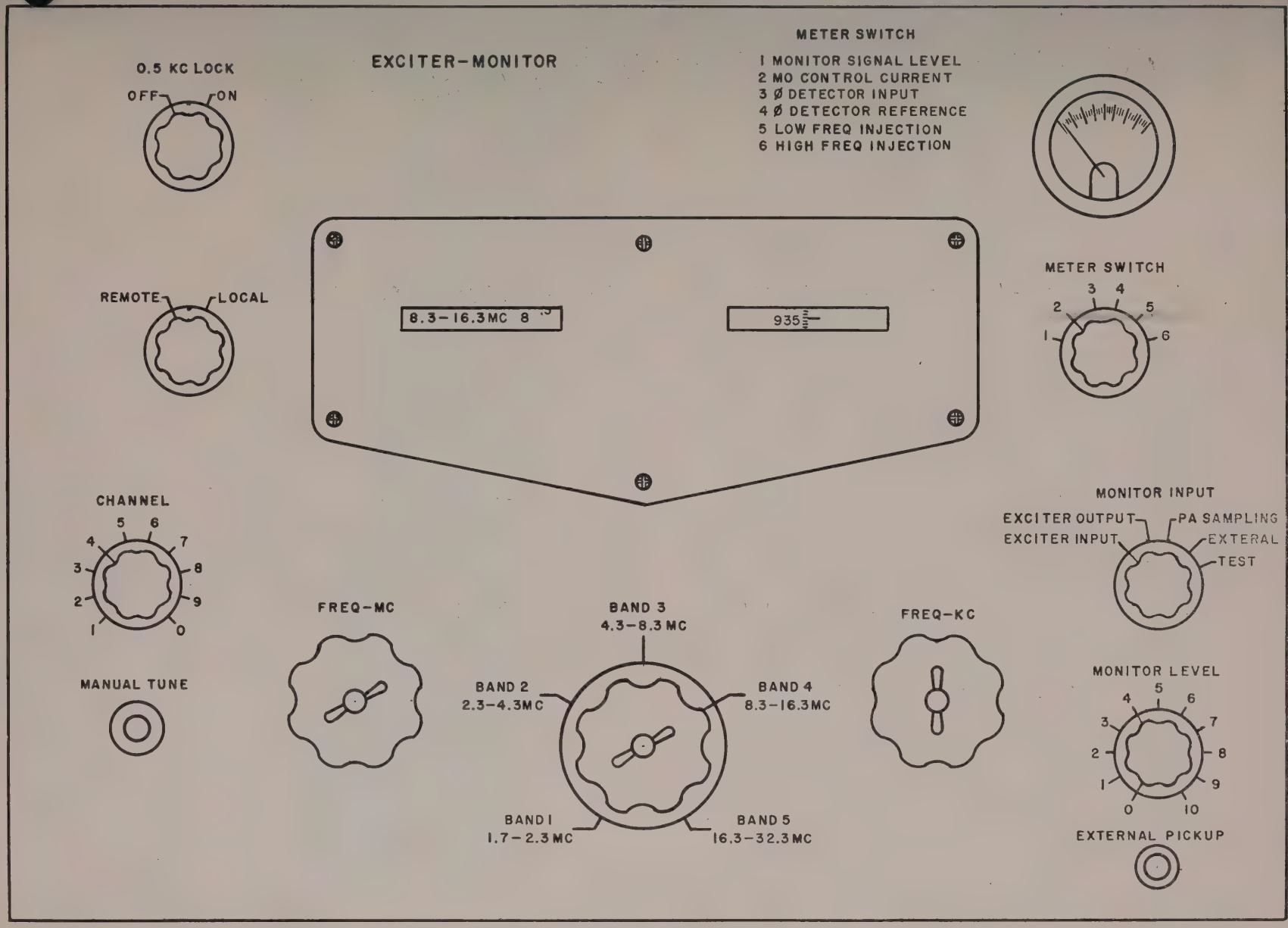

Figure 10. Exciter monitor, front panel.

Control or indicator	Function
	Position — *Frequency range* BAND 1 — 1.7 mc to 2.3 mc BAND 2 — 2.3 mc to 4.3 mc BAND 3 — 4.3 mc to 8.3 mc BAND 4 — 8.3 mc to 16.3 mc BAND 5 — 16.3 mc to 32.3
	Note. After changing bands, see that the FREQ-MC control mechanical detent follower is seated in a detent notch.
MANUAL TUNE push button	Releases mechanical tuning detents for manual tuning operations.

16. Power Supply Control (figs. 7 and 11)

Control or indicator	Function
FILAMENT ON OFF momentary pushbutton switches.	Controls power to the filament circuit, bias power supply, cabinet blower, and servo mechanism.
Filament indicator lamp (green)	Glows when the filament power relay is energized.
LINE indicator lamp (amber)	Glows when 115 v ac is applied to the modulator-oscillator (LINE SWITCH in the ON position).
STABILIZED indicator lamp (blue)	Glows when SMO is phase locked. (No RF output is available until the SMO is phase locked.)
Plate indicator lamp (red)	Glows when the plate power relay is energized.
PLATE ON OFF momentary pushbutton switches.	Controls to power the plate relay in the modulator-oscillator power supply.

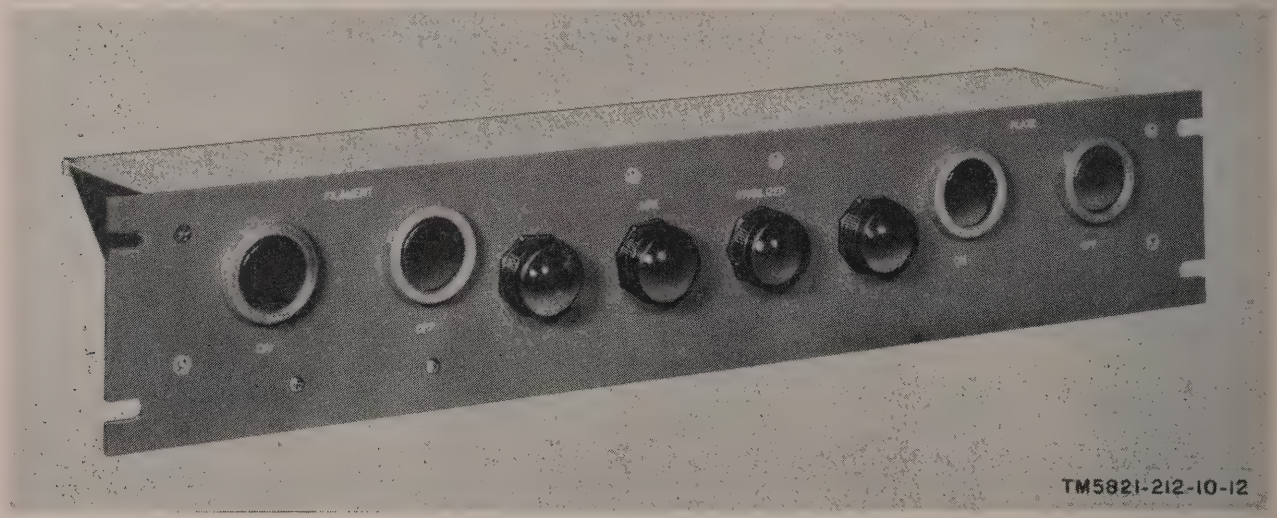

Figure 11. Power supply control, front panel.

17. Automatic Line Voltage Control (figs. 7 and 12)

Control or indicator	Function
AUTOMATIC OR INDICATOR MANUAL switch.	Selects automatic or manual mode of line voltage control.
LINE ADJUST INCREASE knob	Provides manual line voltage adjustment.

Control or indicator	Function
AUTOMATIC ADJUSTMENTS:	
VOLTAGE	Provides adjustment of the line voltage output when the AUTOMATIC-MANUAL switch is placed in AUTOMATIC operation.
SENSITIVITY	Sets sensitivity to line voltage variations (normally set at maximum).
LINE VOLTAGE meter	Indicates adjusted line voltage.

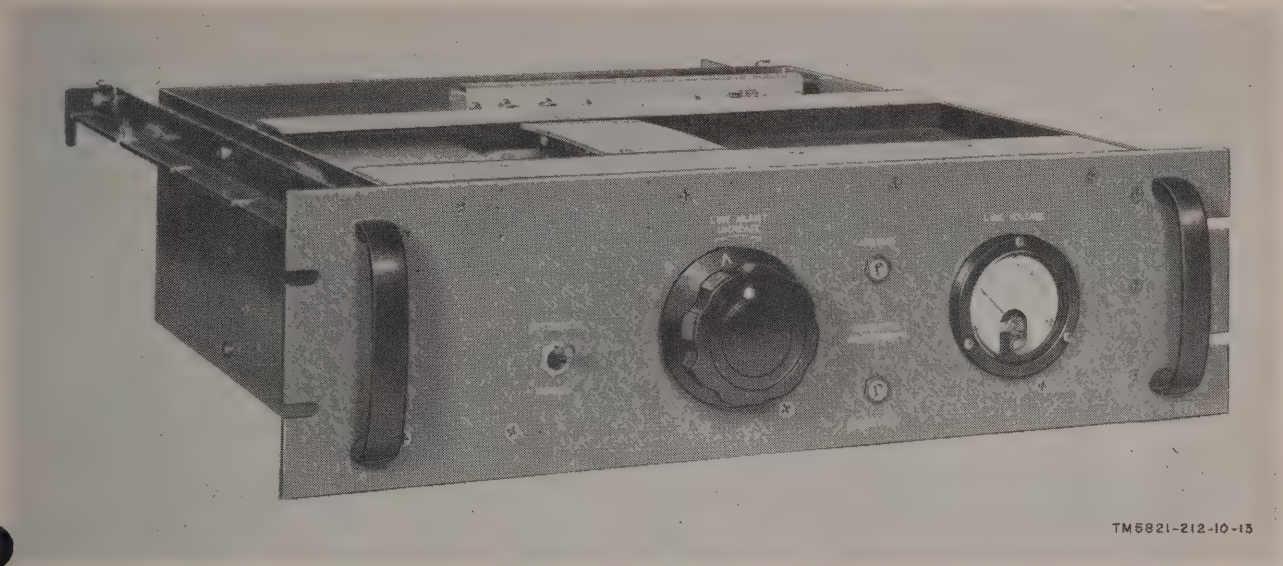

Figure 12. Automatic line voltage control, front panel.

18. Modulator-Oscillator Power Supply (figs. 7 and 13)

Control or indicator	Function
Test meter and meter switch	Meters the output voltage of any one of eight circuits which may be selected by the meter switch. Switch positions and monitoring functions are as follows:

Position	*Function*
1. +28V MOTOR	Measures the 28-volt dc supply to the servo motor.
2. +28V RELAY	Measures the 28-volt dc supply to the 28-volt relays.
3. +300V EXCITER	Measures the 300-volt dc supply to the exciter-monitor and modulator.
4. +300V FREQ. STD.	Measures the 300-volt dc supply to the frequency standard.
5. +150V FREQ. STD.	Measures the 150-volt dc supply to the frequency standard.
6. +125V EXCITER	Measures the 125-volt dc supply to the exciter-monitor and modulator.
7. +210V EXCITER	Measures the 210-volt dc supply to the exciter-monitor and modulator.
8. —150V BIAS	Measures the negative 105-volt dc bias supply.

FREQ. STD. PLATE fuse	Protects frequency standard dc supply circuits.
MAIN PLATE fuse	Protects all the dc circuits of the modulator and exciter-monitor.
BIAS SUPPLY fuse	Protects the negative 105-volt dc supply circuit.
AUTOTUNE & RELAYS fuse	Protects the 28-volt motor and relay supply primary circuits.

Control or indicator	Function
RELAY POWER fuse	Protects all relays except K803 in the exciter monitor.
RECTIFIER FIL fuse	Protects the filament circuits in the thyratron rectifiers of the modulator and exciter-monitor supply.
REGULATOR FIL fuse	Protects filaments of the +210-volt and +125-volt regulator tubes.
FREQ. STD. FIL fuse	Protects the filament transformer in the exciter-monitor junction box.
EXCITER FIL fuse	Protects filaments of all exciter-monitor tubes.
MODULATOR FIL fuse	Protects the filament transformer in the modulator junction box.

Figure 13. Modulator-oscillator power supply, front panel.

19. Remote Control Unit

(fig. 14)

Control or indicator	Function
SERVICE switch	Provides remote selection of the type of service for the RF amplifier. This switch functions the same as the SERVICE switch in the RF amplifier (par. 11). Corresponding lamps on the remote control unit indicate the type of service selected.
AUTOMATIC TUNING switch	Controls remote application of servo power. The OPERATE, CYCLE OFF, AND RESET switch positions parallel identical switch positions on the RF amplifier chassis and serve the same function (par. 11).

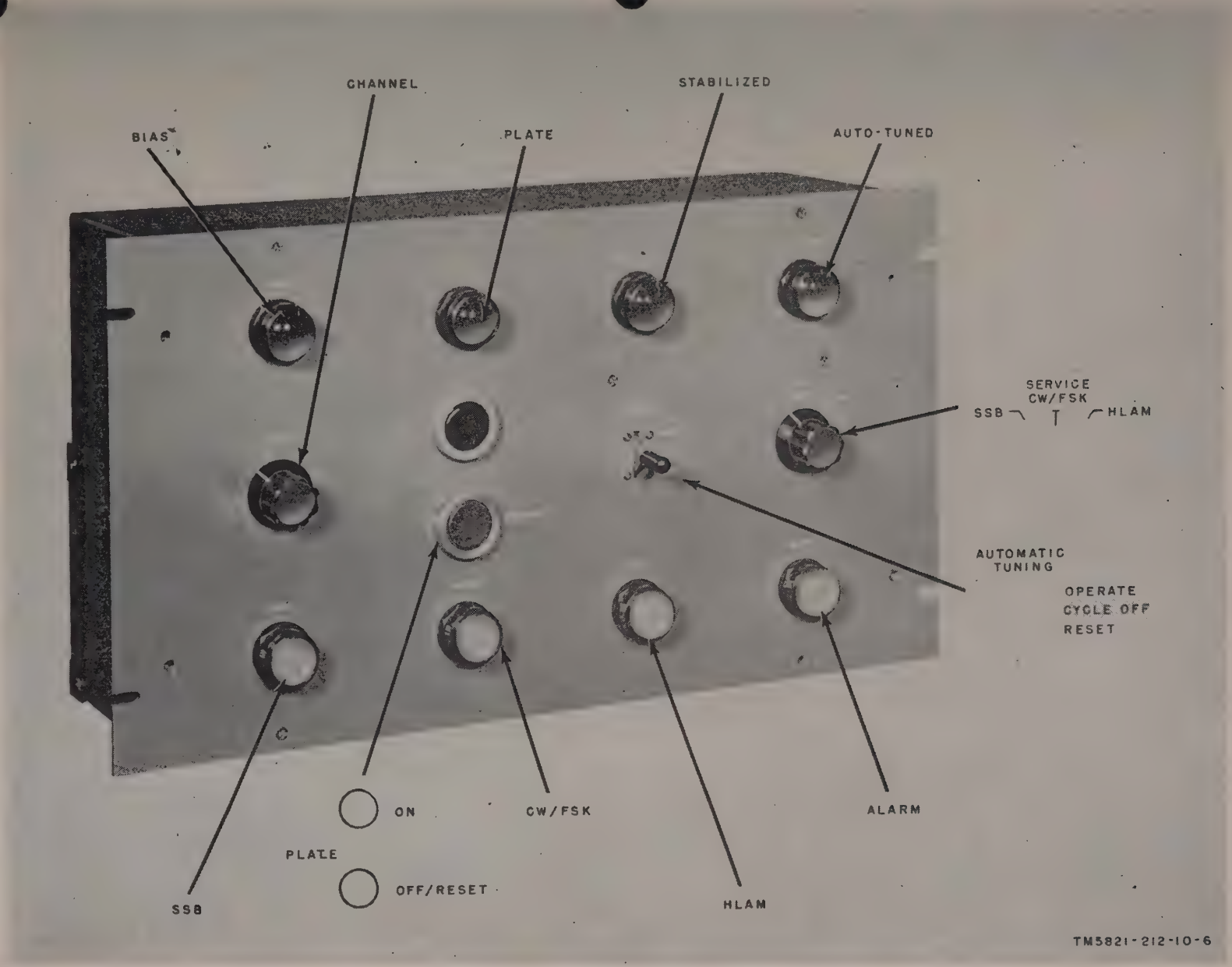

Figure 14. Remote control unit, front panel.

Control or indicator	Function
PLATE ON momentary pushbutton switch.	Turns on the positive dc supplies in the power supply, and the modulator oscillator with the PLATE lamp indicating this condition.
PLATE OFF/RESET momentary pushbutton switch.	Removes dc from plate circuits. If the alarm energizes because of some bias supply circuit failure, this switch must be pressed before power can be reapplied by the PLATE ON switch.
BIAS amber lamp	Indicates energization of power amplifier bias supply in the RF amplifier.
PLATE red lamp	Indicates energization of the plate circuits.
STABILIZED blue lamp	Indicates that the SMO unit in the modulator-oscillator is correctly tuned and supplying the correct frequency to the RF amplifier.
AUTO-TUNED blue lamp	Indicates that the RF amplifier is properly tuned.
CHANNEL selector switch	Selects any one of 10 preset frequencies from the modulator-oscillator.
ALARM white lamp	Provides visual warning of failure of any one of the dc supply circuits in the power supply assembly.
SSB, CW/FSK, and HLAM white lamps.	Indicate the type of service being used.

20. Dummy Antenna

(fig. 15)

Control or indicator	Function
BLOWER ON switch	Controls application of 230-volt, single-phase power to the blower in the dummy antenna subject to control by the STANDBY switch on the RF amplifier door.
RF current ammeter	Meters input current to the dummy antenna.

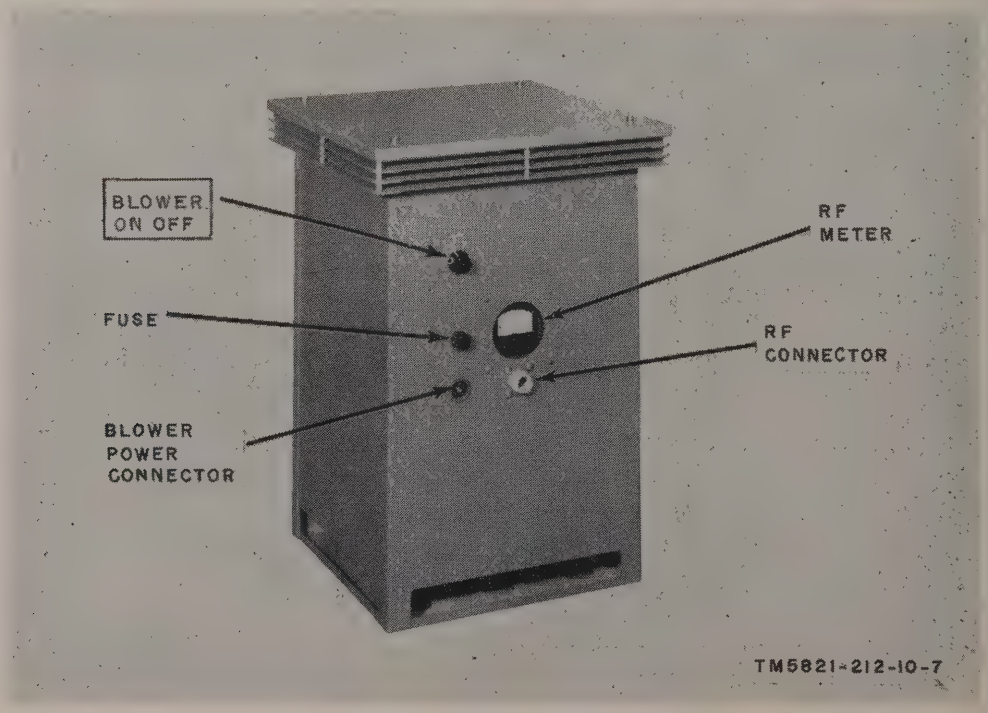

Figure 15. Dummy antenna.

Section II. PRELIMINARY STARTING PROCEDURES

21. Types of Operation

Radio Transmitting Set AN/FRT–51 may be operated locally or remotely. When operated locally, twin- or single-sideband, or low-level amplitude modulation operation is possible. The same facilities are available remotely through the use of Amplifier Control C–1637A/GR. Other methods of operation are possible when additional equipment (par. 9) is used.

22. General

The starting procedure for the transmitting set consists of the preliminary starting procedures (pars. 23 and 24) and the starting procedures for twin sideband or single sideband and low-level amplitude modulation methods of operation. The stabilized master oscillator requires a 24-hour warmup to insure maximum stability; therefore, the transmitting set is normally left in the STANDBY ON condition (par. 35) unless it is to be turned off for an extended period of time.

23. Hv Power Supply and RF Amplifier (figs. 4 and 5)

Perform the preliminary starting procedure outlined below before starting the equipment as described in paragraphs 25 through 35. It is assumed that the equipment has been adjusted and checked by higher echelon repairmen during the initial adjustment of the transmitter. All controls listed are on the power supply unless noted otherwise.

Note. If an abnormal indication is obtained during the preliminary starting procedure, refer to the operational check list (par. 39*c*) for corrective measures. If the corrective measures do not restore normal operation, higher echelon repair is required.

a. Press the RF amplifier STANDBY OFF switch.

b. Set all the hv power supply circuit breakers to ON.

c. Set the ADJUSTED LINE VOLTAGE switch to L1L2, and adjust the line voltage with the LINE ADJUST INCREASE knob to 220 volts as indicated by the ADJUSTED LINE meter. Set the ADJUSTED LINE VOLTAGE switch to L1L3 and L2L3 and see that the ADJUSTED LINE meter reads 220 volts.

d. Set the ALARM switch to the type of alarm signal (AUDIBLE or VISUAL) desired during operation.

e. The transmitter is now in the STANDBY OFF condition, ready for starting as outlined in paragraphs 25 through 34.

24. Modulator-Oscillator (fig. 7)

Perform the following steps to prepare the modulator-oscillator for operation:

a. Operate the LINE switch to ON.

b. Set the AUTOMATIC-MANUAL switch (fig. 12) on the automatic line voltage control to AUTOMATIC. The LINE VOLTAGE meter should indicate 115 volts ac.

Note. The 1-mc crystal standard oven should be on for 24 hours to insure stable operation. Except when the modulator-oscillator is to be off for an extended period or when removal of power is required for maintenance, the LINE switch should be on continuously.

c. See that the amber indicating light is on.

d. For local operation, set the REMOTE-LOCAL switch to LOCAL (fig. 10).

e. Tighten the winged locking keys on the FREQ-MC, BAND, and FREQ-KC switches on the exciter-monitor chassis (fig. 10).

Section III. STARTING AND STOPPING PROCEDURES FOR MODULATOR-OSCILLATOR

25. General Starting Procedure

***Caution:* Before operating the equipment, see that the winged locking keys on the FREQ-MC, BAND switch, and FREQ-KC on the exciter-monitor (fig. 10) are tight.**

a. Press the FILAMENT ON button (fig. 11). The green FILAMENT indicator lamp will glow. See that the modulator-oscillator cabinet blower is operating.

b. Operate the CHANNEL switch of the exciter-monitor assembly to the channel that has been preset to the desired frequency.

c. Press the PLATE ON button (fig. 11). The red indicator lamp comes on. After a few seconds, the blue STABILIZED indicator lamp should glow. The RF output signal is now being applied to the RF amplifier.

d. See that no blown-fuse indicators are glowing.

26. Starting Procedure for TSB or SSB Operation

(fig. 9)

The preliminary starting and general starting procedures (pars. 24 and 25) should be completed before performing the steps listed below.

Note. The CARRIER ATTENUATION controls (*a* below) determine the level of carrier signal that is reinserted in the output of the twin sideband generator. It is important for the operator of this equipment to know what receiving system is to be used. The receiving system will determine the amount of carrier attenuation required.

a. Set the CARRIER ATTENUATION controls for the desired amount of reinserted carrier attenuation. The attenuation is the sum of the readings of the two attenuation controls.

b. Set both LINE METER switches to 0.

c. Adjust the audio frequency input levels of both LINE 1 and LINE 2 (when both are used) for peak readings of 0 on their respective VU meters.

d. Operate the UPPER SIDEBAND and LOWER SIDEBAND selector switches on the TSB modulator panel to place the LINE 1 and LINE 2 audio inputs on the desired sideband channels.

27. Modulator-Oscillator Starting Procedure for Low-Level Amplitude Modulation

(fig. 9)

The preliminary starting and general starting procedures (pars. 24 and 25) should be completed before performing the steps listed below.

a. Set the CARRIER ATTENUATION controls to 0.

b. Set both LINE METER switches to 0.

c. Adjust the audio frequency input level of LINE 1 or LINE 2 (depending upon which line the audio is applied to) for a peak reading of 0 on the respective VU meter.

d. Place *both* UPPER SIDEBAND and LOWER SIDEBAND selector switches to the same line (the one to which audio is applied).

28. Tuning Procedure

(fig. 10)

The servo-driven mechanical tuning system provides for automatic tuning of any one of 10 preset frequency channels in the range of 1.7 to 32.3 mc. Each channel may be setup on any frequency within the operating range of the transmitter. Each position of the CHANNEL selector switch will correspond to a preset frequency; when this switch is positioned, the exciter will be tuned automatically to the corresponding frequency. When required, the system may be tuned manually (*b* below) by changing the tuning of any one of the 10 preset channels. During tuning procedures, the blue STABILIZED indicator lamp (fig. 11) will be extinguished automatically until a few seconds after the procedure is completed. RF output is not available while this indicator is extinguished.

a. Presetting Channel Frequencies. Perform the procedures in (1) through (9) below to set up a preset channel frequency. The numbers in parentheses indicate the settings to obtain a frequency of 9.1565 mc on channel 2.

(1) Tighten the locking keys associated with the FREQ-MC, FREQ-KC, and BAND controls by turning them fully clockwise.

***Caution:* To prevent loss of channel settings, be certain that the winged locking keys for the FREQ-MC, FREQ-KC, and BAND controls are tightened before pressing the FILAMENT ON button of the modulator-exciter control panel, switching the REMOTE-LOCAL control, or switching the CHANNEL selector.**

(2) Turn the REMOTE-LOCAL control to LOCAL.

(3) Turn the CHANNEL selector to the desired channel (2).

(4) After the autotune mechanism stops, rotate the locking keys associated with the FREQ-MC, FREQ-KC and BAND controls counterclockwise about turns.

(5) Set the BAND switch on the desired band (4 with 8.3-16.3 mc indication on dial mask).

(6) Press the MANUAL-TUNE push button, and rotate the FREQ-MC control to obtain the desired mc reading (9.1) within the band presented by the mc digits on the frequency dial.

(7) Hold the MANUAL-TUNE push button pressed, and rotate the FREQ-KC control to obtain the desired kc reading (565) presented by the last three digits on the frequency dial.

(8) Release MANUAL TUNE push button, and check to make sure the FREQ-MC detent follower is in a detent notch. Turn the winged locking keys associated with the FREQ-MC, FREQ-KC, and BAND controls fully clockwise.

(9) If the operating frequency falls on a 0.5-kc point, turn the 0.5 KC LOCK switch to ON. If the operating frequency falls between .5-kc points, the 0.5 KC LOCK switch must be set to OFF. (In the example, 9.1565 mc, the 0.5 KC LOCK switch should be set to ON).

b. Manual Tuning. Perform the following procedures to tune the exciter-monitor manually.

(1) Turn the locking keys associated with the FREQ-MC, FREQ-KC, and BAND controls fully clockwise.

(2) Turn the REMOTE-LOCAL control to the LOCAL position.

(3) Rotate the CHANNEL selector to select either a channel which is not tuned to a preset frequency or to a channel the frequency of which may be changed.

(4) Rotate the locking keys associated with the FREQ-MC, FREQ-KC, and BAND controls counterclockwise.

(5) Set the BAND switch on the desired band.

(6) Press the MANUAL TUNE push button, and rotate the FREQ-MC and FREQ-KC controls to obtain the desired operating frequency within the selected band on the frequency dial. Release the MANUAL TUNE push button, and check to make sure the FREQ-MC detent follower is in a detent notch.

(7) For continued manual tuning, repeat the steps in (5) and (6) above to select other frequencies.

(8) Repeat the step in (1) above before changing the position of the channel selector.

29. Modulator-Oscillator Stopping Procedure (fig. 11)

a. For standby operation with the filaments lighted, press the PLATE OFF button of the modulator-oscillator power control panel.

b. To turn the modulator-oscillator off when a transmitting schedule has been completed, press the FILAMENT OFF button of the modulator-oscillator power control panel.

Note. After pressing the FILAMENT OFF button, filament and plate voltages of the crystal frequency standard are still on. Ordinarily, the frequency standard should be on at all times to insure most stable operation.

c. If transmission is to be discontinued indefinitely, operate the modulator-oscillator LINE switch (fig. 7) to its off position. After the LINE switch is off and the frequency standard has cooled, approximately 24 hours warmup time is required to obtain most stable operation.

Section IV. STARTING AND STOPPING PROCEDURE FOR HV POWER SUPPLY AND RF AMPLIFIER

Note. The starting and operating procedure for twin-sideband and single sideband are identical.

30. Starting Procedure for SSB (or TSB) Operation

For SSB operation, make sure that the BAND SWITCH on the RF amplifier cabinet has been *set to OFF*. The operating frequency is determined by the modulator-oscillator group, which provides for automatic tuning to any one of 10 preset frequency channels. Each channel is preset to a desired frequency with the FREQ-MC, FREQ-KC, and BAND controls on the

exciter-monitor panel of the modulator-oscillator group. Thereafter, when the CHANNEL switch on the exciter panel is set to a selected channel, the servo-controlled mechanical tuning system automatically tunes the modulator oscillator to the preset frequency of the selected channel. The output signal from the exciter is a twin-sideband, reduced carrier, RF signal containing the intelligence to be transmitted. The RF amplifier band switch motor automatically sets the RF amplifier band seeking switch to the same band as the exciter. The servos of the RF amplifier automatically resonate the variable tuned tank circuits in the RF amplifier to the frequency of the RF signal from the exciter. The signal is amplified to a 4-kilowatt (peak envelope power) output level by the RF amplifier. During SSB service, the RF amplifier operates as a linear class B amplifier and reproduces the input wave forms at its output.

31. Starting Procedure for Local SSB (or TSB) Operation
(figs. 4 and 5)

For SSB operation with LOCAL control and AUTOMATIC tuning, perform the steps listed below after completing the preliminary starting procedure (pars. 23 and 24). For REMOTE operation, see paragraph 32. For MANUAL TUNING operation, see paragraph 34. All controls listed are on the RF amplifier panel unless noted otherwise.

Note. If an abnormal indication is obtained during the starting procedure, refer to the (operational check list par. 39*c*) for corrective measures.

a. Set the POWER switch to NORMAL.

b. Set the BAND SWITCH to OFF.

c. Set the CONTROL switch to LOCAL.

d. Set the SERVICE switch to SSB.

e. Set the TUNING switch to AUTOMATIC.

f. Set the AUTOMATIC TUNING switch to OPERATE or CYCLE OFF depending on whether or not constant surveillance is desired.

g. Set the TRANSMITTER TEST switch to OPERATE.

h. Press the STANDBY ON switch.

(1) The RF amplifier and power supply FILAMENT indicators light.

(2) The SSB indicator lights.

(3) The AUTO-TUNED indicator lights.

(4) After 30 seconds, the RF amplifier and power supply BIAS indicators light.

i. After the BIAS indicators light, press the PLATE ON switch.

(1) The RF amplifier and power supply PLATE indicators light.

(2) The AUTO-TUNED indicator goes out when the RF amplifier automatically switches to TUNE power, then lights again after tuning has been completed.

j. The transmitting set is now in local SSB operation.

32. Starting Procedure for Remote SSB (or TSB) Operation
(fig. 4)

For SSB operation using the remote control unit and AUTOMATIC tuning, perform the steps listed below after completing the preliminary starting procedure (pars. 23 and 24). Starting from the STANDBY OFF condition, the procedure below outlines the steps for placing the RF amplifier in remote SSB operation.

a. Press the RF amplifier STANDBY ON switch.

b. Set the RF amplifier TUNING switch to AUTOMATIC.

c. Set the RF amplifier TRANSMITTER TEST switch to OPERATE.

d. Set the RF amplifier CONTROL switch to REMOTE.

e. The STABILIZED indicator on the remote control unit will light if an excitation signal at the correct frequency is being applied from Modulator-Oscillator Group OA–2180/FRT–51.

f. Set the remote POWER switch to NORMAL.

g. Check that the AUTO-TUNED indicator lights at once and the remote BIAS indicator lights approximately 30 seconds after pressing the STANDBY ON switch.

h. The transmitting set is now in the remote STANDBY ON condition.

i. Set the remote AUTOMATIC TUNING switch to OPERATE or CYCLE OFF, depending on whether or not constant surveillance is desired.

j. Set the remote SERVICE switch to SSB. See that the remote SSB indicator lights.

k. Press the remote PLATE ON switch. See that the remote PLATE indicator lights. The AUTO-TUNED indicator goes out when the RF amplifier automatically switches to TUNE power, then lights again after the tuning has been completed.

l. The amplifier is now in remote SSB operation.

m. To return the remote STANDBY ON condition, press the remote PLATE OFF/RESET switch. See that the remote PLATE indicator goes out.

33. RF Amplifier Starting Procedure for Low-Level Amplitude Modulation

The starting procedure for low-level amplitude modulation is similar to that for SSB (par. 26). The only difference is in the switch settings in the modulator-oscillator which are covered in paragraph 27.

34. Starting Procedure for Manual Tuning (fig. 4)

a. General. Make sure that a suitable exciter-monitor such as Modulator-Oscillator Group OA-2180/FRT-51 is used. Set the BAND SWITCH to OFF. The tank circuits of the RF amplifier must be manually tuned to resonate with the incoming RF signal from the exciter.

b. SSB, or TSB, or Low-Level Amplitude Modulation. For SSB, TSB, or low-level amplitude modulation service, perform the steps listed below after completing the preliminary starting procedure (pars. 23, 24, and 25). All controls listed are on the RF amplifier panel unless noted otherwise.

Note. If an abnormal indication is obtained during the starting procedure, refer to the operation check list (par. 39*c*) for corrective measures. If these measures do not correct the fault, higher echelon repair is required.

(1) Set the POWER switch to TUNE.
(2) Set the CONTROL switch to LOCAL.
(3) Set the SERVICE switch to CW/FSK.
(4) Set the TUNING switch to MANUAL.
(5) Set the AUTOMATIC TUNING switch to OPERATE or CYCLE OFF.
(6) Set the TRANSMITTER TEST switch to OPERATE.
(7) Press the STANDBY ON switch.
  (*a*) The RF amplifier and power supply FILAMENT indicators light.
  (*b*) The CW/FSK indicator lights.
  (*c*) After 30 seconds, the RF amplifier and power supply BIAS indicators light.
(8) Set the PA PLATE TUNING and PA LOADING knobs so that their associated dials (located directly below the respective knobs) read approximately the same as the input frequency.
(9) Set the BUFFER TUNING and DRIVER PLATE TUNING knobs in a counterclockwise direction to the stop.
(10) After the BIAS indicators light, press the PLATE ON switch. The RF amplifier and power supply PLATE indicators light.
(11) Adjust the BUFFER TUNING knob clockwise for the first peak in the DRIVER CATHODE meter reading. Refer to the tuning chart (fig. 16) for the buffer stage. For example, if the operating frequency is 7 mc the buffer dial reading will be approximately 5.
(12) Adjust the DRIVE PLATE TUNING knob clockwise for the first dip in the DRIVER CATHODE meter reading. There will be a rise indicated on the PA GRID and PA PLATE current meters. Refer to the tuning chart (fig. 17) to check the tuning of the driver stage. For example, if the operating frequency is 7 mc, the driver dial reading will be between 3 and 4.
(13) Adjust the PA PLATE TUNING knob for a dip in the PA PLATE meter reading. Readjust the PA PLATE TUNING and PA LOADING knobs until, at resonance, the PA PLATE meter reads .5 ampere. Loading is increased by turning the PA LOADING knob clockwise. The PA PLATE TUNING knob must be turned counterclockwise to resonate with loading increases.
(14) Set the POWER switch to LOW.
(15) Readjust the PA PLATE TUNING and PA LOADING knobs until, at resonance, PA PLATE meter indicates 1 ampere.
(16) Set the POWER switch to NORMAL.

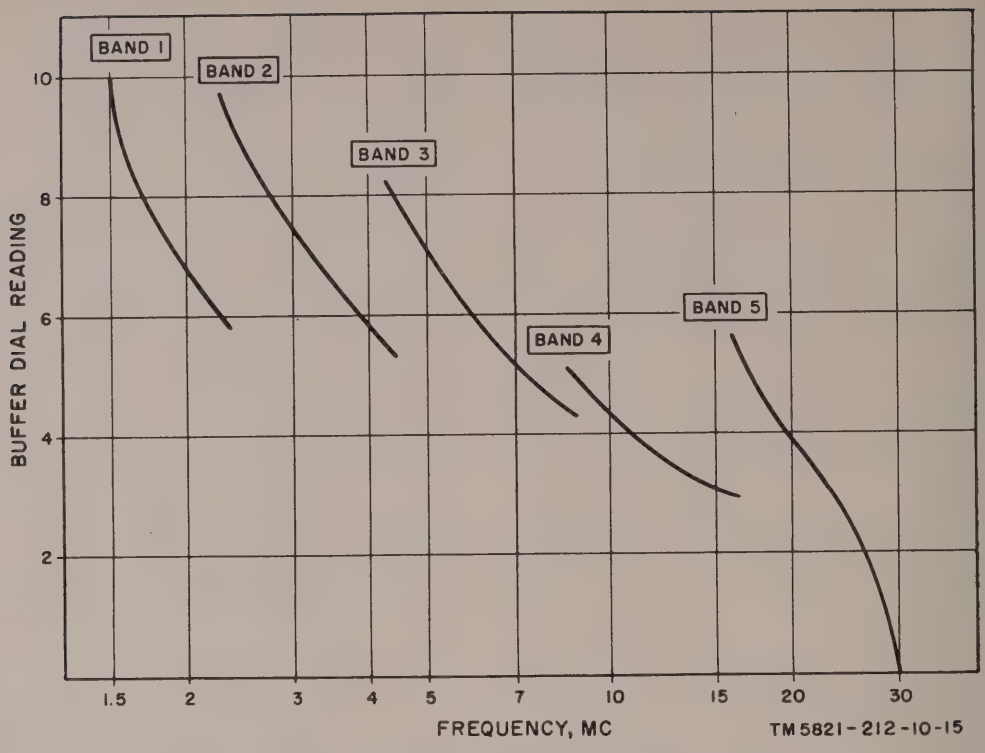

Figure 16. Buffer stage, tuning chart.

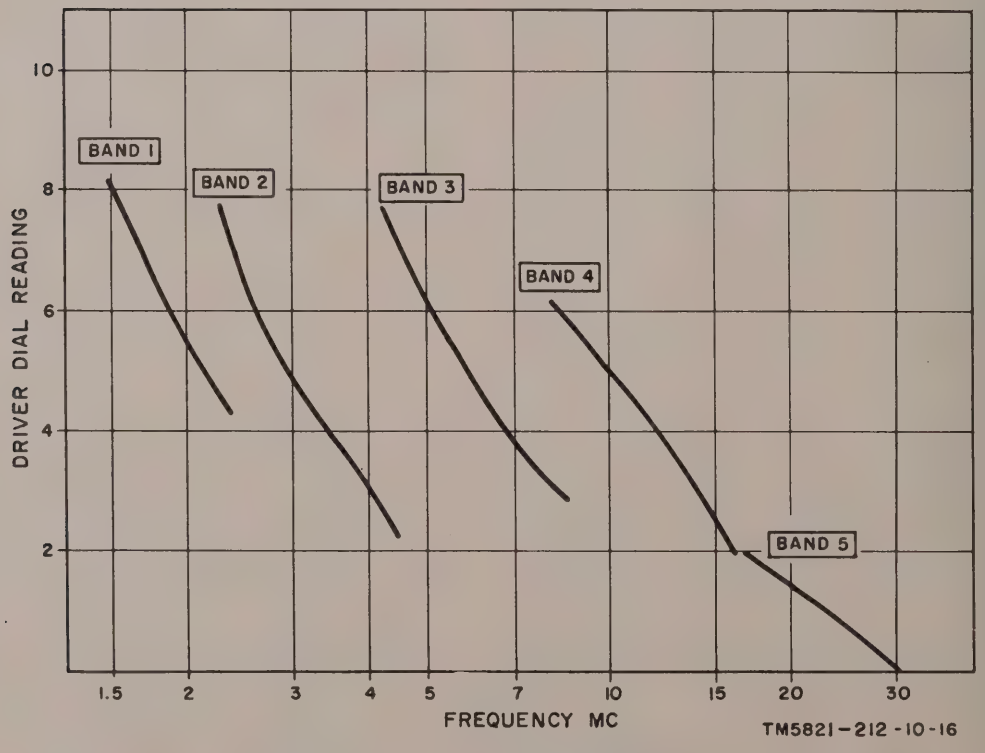

Figure 17. Driver stage, tuning chart.

After approximately 3 seconds, the AUTO-TUNE indicator lights.

(17) Readjust the PA PLATE TUNING and PA LOADING knobs until, at resonance, the PA PLATE meter indicates 1.7 amperes.

(18) Press the PLATE OFF/RESET switch. The PLATE indicators go out.

(19) Set the SERVICE switch to SSB. The SSB indicator lights.

(20) Press the PLATE ON switch. The PLATE indicators light.

(21) The transmitting set is now in local SSB, TSB, or low level amplitude modulation operation depending upon the type of excitation.

35. Stopping Procedure (fig. 4)

a. General. The RF amplifier and power supply may be placed in one of three varying conditions of shutdown: STANDBY ON, STANDBY OFF, or complete shut down. With the equipment in full operation, deenergize it as desired by performing one of the following procedures.

b. STANDBY ON Stopping Procedure. Press the RF amplifier PLATE OFF/RESET switch. See that the PLATE indicators extinguish. The FILAMENT, BIAS, and AUTO-TUNE indicators remain lighted.

c. STANDBY OFF Stopping Procedure. Press the RF amplifier STANDBY OFF switch. See that the FILAMENT, BIAS, and PLATE and AUTO-TUNE indicators go out.

d. Complete Shut Down. Place the equipment in the STANDBY OFF condition by pressing the STANDBY OFF switch. Then open the power supply door and set the PWR INPUT circuit breaker (fig. 6) to OFF.

CHAPTER 3
MAINTENANCE INSTRUCTIONS

36. Scope of Operator's Maintenance

The following maintenance duties normally are performed by the operator of Radio Transmitting Set AN/FRT–51. These procedures do not require special tools or test equipment.

a. Preventive maintenance (par. 37).
b. Visual inspection (par. 38).
c. Operational check list (par. 39).
d. Replacement of defective indicator lamps.
e. Replacement of defective fuses.

37. Preventive Maintenance
(figs. 18 and 19)

DA Form 11–238 is a preventive maintenance check list to be used by the operator and the organizational repairman. Figures 18 and 19 show the form as used by the operator; all second and third echelon inspection items are lined out. Items not applicable to the radio transmitting set are also lined out. Instructions for use appear on the form.

38. Visual Inspection

a. When the equipment fails to operate properly, turn off the power and check all the items listed below.

(1) Improperly connected or defective power connection.
(2) Worn, broken, or disconnected cords or plugs.
(3) Blown fuses or tripped circuit breakers.
(4) Switches (or other controls) set incorrectly.
(5) Knobs of band switches, tuning controls or servo controls loose on shaft.

b. If the above checks do not locate the trouble, proceed to the operational check list (par. 39).

39. Operational Check List

a. General. The operational check list consists only of preliminary starting and operating procedures. The corrective measures listed are those the operator can perform. If the measures suggested do not restore normal equipment performance or if the tuning procedures of paragraphs 25 through 34 do not correct the trouble, trouble shooting by a Fixed Station Transmitter Repairman is required.

b. Procedure. If the modulator-oscillator is being energized initially, begin with the procedures outlined in paragraphs 23 and 24. If the crystal oven has been left on for at least 24 hours, begin with the steps listed in *c* below.

c. Check List for RF Amplifier and Hv Power Supply.

Step	Action	Normal indication	Corrective measures
1	Set STANDBY switch on RF amplifier to OFF.	The FILAMENT, BIAS, and PLATE indicator lamps are extinguished.	
2	Open power supply cabinet door and turn all circuit breakers to ON. Close cabinet door.	ADJUSTED LINE meter indicates 220 volts.	Refer to step 3.
3	Set the ADJUSTED LINE switch to L1L2.	ADJUSTED LINE meter indicates 220 volts.	Adjust the line voltage to 220 volts with the LINE ADJUST switch.
4	Set the ADJUSTED LINE switch to L1L3.	Same as step 3	Same as step 3.
5	Set the ADJUSTED LINE switch to L2L3.	Same as step 3	Same as step 3.

ADDITIONAL ITEMS FOR 2D AND 3D ECHELON INSPECTIONS	CONDITION
26. ~~INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS.~~	
27. ~~CHECK FOR NORMAL OPERATION.~~	
28. ~~BEFORE SHIPPING OR STORING, REMOVE BATTERIES.~~	

IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING THE INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.

MAINTENANCE CHECK LIST FOR SIGNAL EQUIPMENT
SOUND EQUIPMENT, RADIO, DIRECTION FINDING
RADAR, CARRIER, RADIOSONDE AND TELEVISION
(AR 750-625)

EQUIPMENT NOMENCLATURE: RADIO TRANSMITTING SET AN/FRT-51

EQUIPMENT SERIAL NUMBER: 401

INSTRUCTIONS

This form may be used for a period of one month by using the correct dates and weeks of the month. It is to be used as a Preventive Maintenance check list for Signal equipment in actual use, or for a check on equipment prior to issue.

1. For detailed Preventive Maintenance instructions see:
   a. The Technical Manual *(in TM 11 series)* for the equipment. *(See DA Pamphlet Number 310-4)*
   b. The Supply Bulletin *(SB 11-100 series)* for the equipment. *(See DA Pamphlet Number 310-4)*
   c. The Department of the Army Lubrication Order. *(See DA Pamphlet Number 310-4)*

2. The following action will be taken by either the Communications Officer/Chief for 1st echelon, or the Inspector for higher echelon:
   a. Enter Equipment Nomenclature and Serial Number.
   b. Strike out items that do not apply to the equipment.

3. Operator/Inspector will enter in the columns entitled CONDITION, on the proper line, a notation regarding the condition, using symbols specified under LEGEND.

4. After operator completes each daily inspection he will initial over the appropriate dates under "Daily Condition for Month", then return form to his supervisor.

FOLD

TYPE OF INSPECTION

OPERATOR	2/3 ECHELON	DATE	SIGNATURE
✓		10 FEB	Cpl Rodney Stephen

4

DA FORM 1 MAY 57 11-238

REPLACES DA FORMS 11-238, 1 NOV 55; 11-239 11-244, 11-245, 11-246, 11-249, 11-250, AND 11-251, WHICH ARE OBSOLETE

TM5821-212-10-17

Figure 18. DA Form 11–238, pages 1 and 4.

LEGEND for marking conditions:
Satisfactory, ✓.
Adjustment, Repair or Replacement required, X.
Defect corrected, (X).

DAILY CONDITION FOR MONTH OF

NO.	DAILY ITEM	1 RS 17	2 RS 18	3 RS 19	4 RS 20	5 RS 21	6 RS 22	7 RS 23	8 RS 24	9 RS 25	10 RS 26	11 27	12 28	13 29	14 30	15 31	16	2D 3D ECHELON
1.	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT. (Transmitter, ~~receiver, carrying cases, misc~~, cables, ~~microphones, tubes~~, spare parts, technical manuals).	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓							
2.	CLEAN DIRT AND MOISTURE FROM ~~ANTENNA, MICRO-PHONES, HEADSETS, KEYS,~~ JACKS, PLUGS, COMPONENT PANELS.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓							
3.	INSPECT CONTROLS FOR NORMAL OPERATION. ~~TAP CONTROLS LIGHTLY FOR EVIDENCE OF CUT-OUT FROM LOOSE CONTACTS.~~	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓							
4.	CHECK FOR NORMAL OPERATION OF EQUIPMENT. BE ALERT FOR UNUSUAL OPERATION OR CONDITION.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓							

WEEKLY	CONDITION EACH WEEK 1ST	2D	3D	4TH	5TH	2D 3D ECH
5. CLEAN ~~AND TIGHTEN~~ EXTERIORS OF CASES, ~~RACKS~~, MOUNTS, ~~TRANSMISSION LINES~~.	✓					
6. INSPECT CASES, MOUNTS, ~~ANTENNA TOWERS~~ AND EXPOSED METAL SURFACES FOR RUST, CORROSION.	✓					
7. INSPECT CORDS, CABLE, ~~WIRE, SHOCK MOUNTS~~ FOR CUTS, KINKS, BREAKS, FRAYING, UNDUE STRAIN.	✓					
8. ~~SHOCK ANTENNA GUY WIRES FOR PROPER TENSION OR DAMAGE.~~						
9. ~~INSPECT CANVAS AND LEATHER ITEMS FOR MILDEW, TEARS, FRAYING.~~						
10. INSPECT ACCESSIBLE ITEMS FOR LOOSENESS: SWITCHES, KNOBS, JACKS, CONNECTORS, ~~RELAYS, TRANSFORMERS, MOTORS~~, PILOT LIGHTS, ~~BLOWERS~~, ETC.	✓					
11. CLEAN AND/OR INSPECT AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS.						
12. ~~INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, SPECIFIC GRAVITY, DAMAGED CASES. INSPECT DRY BATTERIES FOR LEAKAGE.~~						

ADDITIONAL ITEMS FOR 2D AND 3D ECHELON INSPECTIONS	CONDITION
13. ~~INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHER PROOFING, TEARS, FRAYING.~~	
14. ~~SHOCK TERMINAL BOX COVERS FOR CRACKS, DIRT, LEAKS, DAMAGED GASKETS, GREASE.~~	

ADDITIONAL ITEMS FOR 2D AND 3D ECHELON INSPECTIONS	CONDITION
15. ~~INSPECT SEATING OF READILY ACCESSIBLE PLUG-IN ITEMS: TUBES, LAMPS, FUSES, CRYSTALS, CONNECTORS, VIBRATORS, PLUG-IN COILS.~~	
16. ~~INSPECT RELAYS AND CIRCUIT BREAKERS FOR LOOSE MOUNTINGS, BAD CONTACTS, MIS-ALINEMENT OF CON-TACTS AND SPRINGS, PROPER SPRING TENSION.~~	
17. ~~INSPECT VARIABLE CAPACITORS FOR DIRT, MIS-ALINEMENT OF PLATES, LOOSE MOUNTINGS, MOISTURE.~~	
18. ~~INSPECT RESISTORS, BUSHINGS AND INSULATORS FOR CRACKS, CHIPPING, BLISTERING, MOISTURE, DISCOLORATION.~~	
19. ~~CLEAN AND TIGHTEN SWITCHES, TERMINAL BLOCKS, BLOWERS, RELAY CASES AND INTERIORS OF CHASSIS AND CABINETS NOT READILY ACCESSIBLE.~~	
20. ~~INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS.~~	
21. ~~INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR DIRT, CORROSION, LOOSE CONTACTS.~~	
22. ~~INSPECT TRANSFORMERS, CHOKES, POTENTIOMETERS AND RHEOSTATS FOR OVERHEATING AND OIL LEAKAGE.~~	
23. ~~INSPECT GENERATORS, AMPLIDYNES, DYNA MOTORS FOR BRUSH WEAR, SPRING TENSION, ARCING AND PITTING OF COMMUTATOR.~~	
24. ~~INSPECT CATHODE RAY TUBES FOR BURNT SCREEN SPOTS.~~	
25. ~~INSPECT WATERPROOF GASKETS FOR LEAKS, WORN OR LOOSE PARTS.~~	

CONTINUED ON PAGE 4

2 3

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Figure 19. DA Form 11–238, pages 2 and 3.

d. Check List for Modulator-Oscillator.

	Action	Normal indication	Corrective measures
1	Operate meter switch on modulator-oscillator power supply to +300V FREQ. STD.	Meter pointer should rest at center of green area (approximately 10 on dial).	Check FREQ. STD. PLATE fuse. Check FREQ. STD. FIL fuse.
2	Operate meter switch on modulator-oscillator power supply to +150V FREQ. STD.	Same indication as step 1	Higher echelon repair required.
3	Press FILAMENT ON button	Filament indicator lights (green). Blower starts.	Check filament indicator lamp.
4	Operate meter switch to +28V MOTOR, +28V RELAY, and 105V BIAS in turn.	Meter pointer should rest at center of green area for each meter switch setting.	Check AUTOTUNE AND RELAYS fuse. Check BIAS SUPPLY fuse.
5	Press PLATE ON button	Plate indicator lights (red). After a few seconds, the blue STABILIZED light comes on.	Check indicator lamp. Check STABILIZING lamp. Check MAIN PLATE fuse.
6	Operate the meter switch on power supply to +300V EXCITER, +125V EXCITER, and +210V EXCITER.	Meter pointer should rest at center of green area for each meter switch setting.	Higher echelon repair required.

CHAPTER 4

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

40. Disassembly

To disassemble the transmitting set:

a. Disconnect all cabling to the equipment.

b. If the equipment is bolted to the floor, remove the bolts.

41. Repackaging for Shipment or Limited Storage

Repackaging of the transmitting set is performed at higher echelons.

Section II. DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

42. Authority for Demolition

Demolition of the equipment will be accomplished only upon order of the commander. The destruction procedures outlined in paragraph 43 will be used to prevent further use of the equipment.

43. Methods of Destruction

Any or all of the methods of destruction given below may be used. The time available will be the major determining factor for the methods to be used in most instances when destruction of equipment is undertaken. The tactical situation also will determine how the destruction order will be carried out. In most cases, it is preferable to demolish completely some portions of the equipment rather than partially destroy all the equipment units.

a. Smash. Use sledges, axes, hammers, crowbars, and any other heavy tools available to smash the interior units of the set.

(1) Use the heaviest tool on hand to smash the servo mechanism, the meters, the dials, and the knobs.

Note. Heavy tools will effectively damage the external parts mentioned in (1) above, but the remainder of the exposed surfaces of the equipment are constructed of steel plate; attempts to damage it by smashing will be useless.

(2) Open the doors of the cabinets. With a heavy hammer or bar, smash as many as possible of the exposed parts of the various chassis. If time permits, remove each panel insert from the modulator-oscillator cabinet, and smash each subchassis individually. Be sure to smash the crystal and crystal-oven assembly in the frequency standard subchassis.

b. Cut. Use axes, handaxes, machetes, and similar tools to cut cabling, cording, and wiring. Use a heavy axe or machete to cut the power cable. Cut all cords and cables in a number of places. If time permits, open the doors of the cabinets and slash the internal cabling and cable harnesses.

c. Burn. Burn as much of the equipment as is flammable; use gasoline, oil, flame throwers, and similar tools. Burn the instruction literature first. Pour gasoline on the cut cables and internal wiring and ignite. Use a flame thrower to burn spare parts or pour gasoline on the spares and ignite them. Use incendiary grenades to complete the destruction of unit interiors.

***Warning:* Be extremely careful with explosives and incendiary devices. Use these items only when the need is urgent.**

d. Explode. Use explosives to complete demolition or to cause maximum damage, when time does not permit complete demolition by other means. Powder charges, fragmentation grenades, or incendiary grenades may be used. In

Incendiary grenades usually are most effective if destruction of small parts and wiring is desired.

(1) Use an incendiary grenade to destroy the servo motor. Be sure the rear door is secured after the genade is placed.

(2) Break the glass on the viewing ports of the RF amplifier and hv power supply. Place incendiary grenades inside the port holes.

(3) For quick destruction of the modulator-oscillator subchassis, remove the units separately and place fragmentation grenades on each one. Get away from the units after the grenades are placed.

e. Dispose. Burn or scatter destroyed parts or throw them into nearby waterways. This is particularly important if a number of parts have not been completely destroyed.

[413.44 (11 Feb 59)]

By Order of *Wilber M. Brucker*, Secretary of the Army:

MAXWELL D. TAYLOR,
General, United States Army,
Chief of Staff.

Official:

R. V. LEE,
Major General, United States Army,
The Adjutant General.

Distribution:

Active Army:

ASA (2)
CNGB (1)
Technical Stf, DA (1) except CSigO (30)
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USA Arty Bd (1)
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USA Armor Bd Test Sec (1)
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USA Abn & Elct Bd (1)
USA Avn Bd (1)
USA Arctic Test Bd (1)
US ARADCOM (2)
US ARADCOM Rgn (2)
OS Maj Comd (5)
OS Base Comd (5)
Log Comd (5)
MDW (1)
Armies (5)
Corps (2)
Div (2)
USATC (2)
Fld Comd, AFSWP (5)
Yuma Test Sta (2)
USA Elct PG (1)
Svc Colleges (5)
Br Svc Sch (5) except USASCS (25)
Gen Depots (2) except Atlanta Gen Depot (none)
Sig Sec, Gen Depot (10)
Sig Depots (17)
AFIP (1)
TASSA (15)
Midwestern Rgn Ofc (TASSA) (1)
WRAMC (1)
AMS (1)
Engr Maint Cen (1)
USA Comm Agcy (2)
USA Sig Comm Engr Agcy (1)
USA Sig Eqp Spt Agcy (2)
USA Sig Msl Spt Agcy (13)
Port of Emb (OS) (2)
Trans Terminal Comd (2)
Army Terminals (2)
OS Sup Agcy (2)
Sig Fld Maint Shops (3)
Sig Lab (5)
Mil Dist (1)
USA Corps (Res) (1)
Sectors, USA Corps (Res) (1)
JBUSMC (2)
USA Sig Pubs Agcy (8)
Army Pictorial Cen (2)
USA Ord Msl Comd (3)
Units org under fol TOE:
11–7 (2)
11–16 (2)
11–57 (2)
11–500 (AA–AE) (2)
11–557 (2)
11–587 (2)
11–592 (2)
11–597 (2)

NG: State AG (3); units—same as Active Army except allowance is one copy to each unit.

USAR: None.

For explanation of abbreviations used, see AR 320–50.

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